

A CULTURAL RESOURCES RECONNAISSANCE PLANNING STUDY

OF THE PROPOSED SUSSEX EAST-WEST CORRIDOR

DELAWARE ROUTES 404/18 AND 9

SUSSEX COUNTY, DELAWARE

DELDOT PROJECT 88-112-01 DELDOT ARCHAEOLOGY SERIES NO. 86

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ABSTRACT

This report is intended to provide planning information on cultural resources, prehistoric and historic archaeological sites and historic standing structures within the proposed Route 404 Corridor. The existing data base consists of all sites listed in the files of the Delaware Bureau of Archaeology and Historic Preservation and these sites are listed in this report with a series of descriptive variables. Additional potential predicted prehistoric site locations were noted using quantitative correlations of known archaeological site locations and environmental variables. Mapping of culturally significant environmental variables was accomplished using LANDSAT-satellite data. Additional potential predicted historic site locations were noted using non-quantitative analyses of historic settlement pattern trends, trends among known standing structure locations and data from historic atlases. Based on all these data sources, and potential site significance, the entire project area was categorized into management units based on varied cultural resource impact sensitivity. Maps of all predicted site locations, known site locations, and management units are included.

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INTRODUCTION

This report presents the results of cultural resources planning study of the proposed Sussex East-West Corridor, Delaware Routes 404/18 and 9, in Sussex County, Delaware (Figure 1). The study was conducted between March and August of 1989 by archaeologists from the University of Delaware, Center for Archaeological Research (UDCAR), by the request of the Delaware Department of Transportation (DelDOT) to provide planning information for the Sussex East-West Corridor for compliance with Section 106 of the National Historic Preservation Act in consultation with the State Historic Preservation Office in the Bureau of Archaeology and Historic Preservation (BAHP). Funding for the project was provided by the Delaware Department of Transportation and the Federal Highway Administration (FHWA).

The Sussex East-West Corridor extends from the Maryland-Delaware boundary at Adams Crossroads to the vicinity of Five Points on State Route 1; it is approximately 30 miles long and five miles wide, centered on State Roads 404, 18, 40, and 9 The proposed Corridor is located almost exclusively (Figure 2). in Sussex County, with the exception of a small portion of the proposed Corridor in the extreme northwestern section near Hickman, which is in Kent County. All of the area within the project corridor was included in the study area, except for the town of Bridgeville, the town of Georgetown, the National Register District of Belltown, and the Historic District at Harbeson. These areas contained historic sites in concentrated numbers, and were avoided during this planning survey. specific goals of the project were to identify zones within the

FIGURE 1 Project Corridor Location

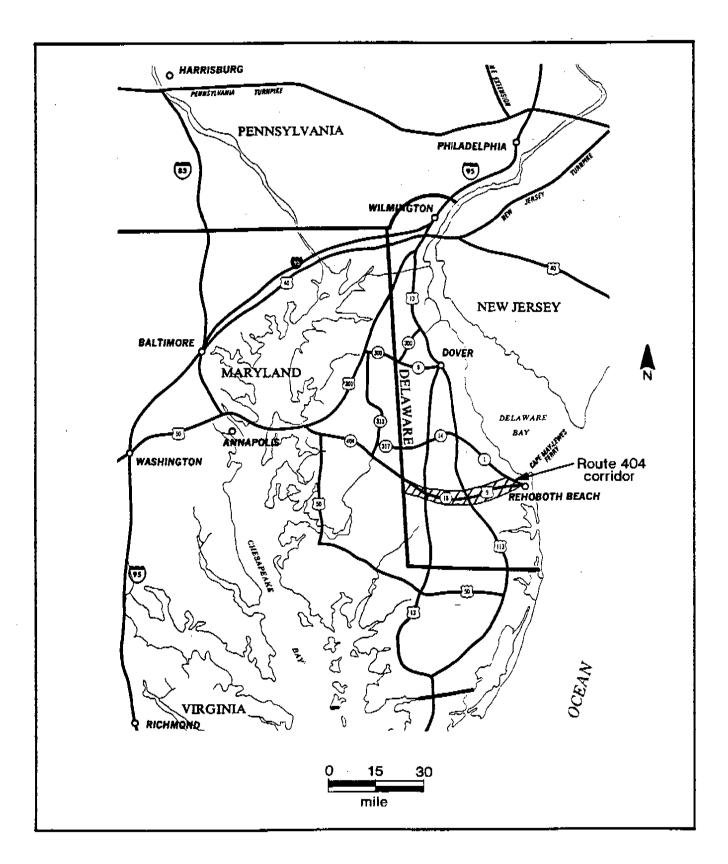


FIGURE 2
Map of Project Corridor

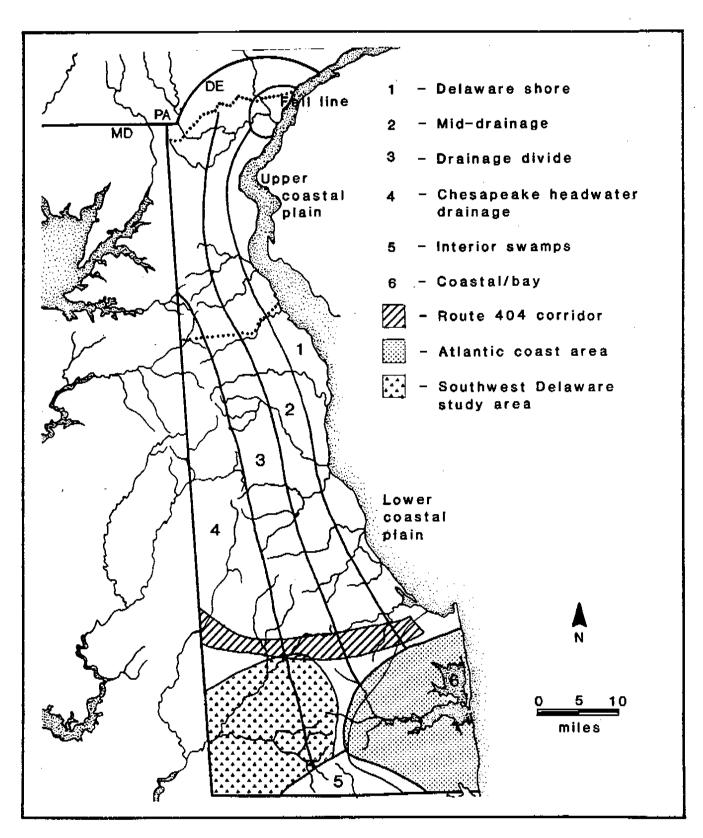
Corridor that were likely to contain significant prehistoric archaeological, historic archaeological, and/or historic standing structures. The project did not seek to determine the significance of any particular site or structure. Rather, it sought to outline the potential cultural resources that may be encountered in various sections of the proposed Corridor. Further survey work will be necessary to determine the impact of proposed individual alignments on specific sites and to determine the eligibility of these sites for listing on the National Register of Historic Places.

The report is organized in several sections. The first section provides a brief description of the environmental setting of the project area, and reviews the regional prehistory and history of the lower Delmarva Peninsula and Sussex County. second section presents the existing data base of information available on the prehistoric and historic resources located within the project corridor. The cultural context of this information and the quality of the existing data is discussed. The third section of the report describes the application of predictive models to planning studies, discusses the various predictive models utilized in this study, and presents the results of their application within the project corridor. application of LANDSAT satellite data in the development of the prehistoric predictive model for the project corridor is also The fourth section of the report discusses the potential significance of the known prehistoric and historic resources in the project corridor, and addresses the potential significance of sites that may be discovered based on the applications of predictive modelling. A series of sensitivity zones (management units) based on the potential occurrence of significant sites is also presented and described, and recommendations concerning cultural resource management strategies are provided. The final three sections of this report are accompanied by a series of small-scale maps illustrating site locations, predicted site locations, and sensitivity zones.

ENVIRONMENTAL SETTING

The study area falls within the Low Coastal Plain physiographic zone (Figure 3), which includes most of Kent and Sussex Counties. The Low Coastal Plain is underlain by the sands of the Columbia Formation (Jordan 1964; Delaware Geological Survey 1976) and these sands have been extensively reworked by various geological processes. The result is a very flat and relatively featureless landscape with elevation differences that range up to 10 meters (30 feet). These small differences in elevation are further moderated by long and gradual slopes. Surface water settings have been severely affected by rising sea level and most river systems, including much of the Nanticoke, Marshyhope, Broadkill, their tributaries and lower order tributaries of Indian River and Rehoboth Bay in the study area, are tidal in their middle and lower reaches. In general, the watercourses of the study area, particularly the main course of the Nanticoke River, some of its larger tributaries, such as Deep Creek, Broad Creek, and Clear Brook, and the Marshyhope provide a richer range of resources than the less well watered

FIGURE 3 Physiographic Setting



interior. Therefore, for the purposes of this report two basic environmental zones, the riverine settings and the interior, will be delimited for the survey area.

Most of the riverine areas of the Sussex East-West Corridor have an associated fringing tidal marsh characterized as the Arrow-Arum - Pickerel Weed Marsh Type (Zone VI - Daiber et al. 1976:86-87, Figure 25). These marshes occur within tidal mud flats where the water salinity ranges between fresh and slightly brackish. The prominent plants are Arrow-arum and pickerel weed; and reed grass, marsh mallow, and wild rice are also common. Many species of duck and muskrat are found in the area and various species of fish, including anadramous species, use these marshes as spawning areas. In general, these marshes provide a plethora of faunal and floral food sources not seen in other parts of the study area. Adjacent to the fringing marsh there is usually a steep bluff which is undergoing continual erosion. Cultivation often extends right up to the bluff, but in some cases a fringing woodland of hydrophytic species such as loblolly pine, sweet gum, mixed oaks, and Virginia pine (Ireland and Matthews 1974), is present. In a few places along the Nanticoke there are some developed floodplain settings, but these geomorphological settings are rare. For the most part, movement of the main channel of the major drainages has been constrained between the present river-edge bluffs over the course of the last 10,000 years.

Cypress swamps along some of the higher order tributaries of the Nanticoke, such as in the vicinity of James Branch, Hitch Pond, and Trussum Pond provide a unique environmental setting within the riverine area. In the study area, as is the case throughout the Delmarva Peninsula, cypress swamps are located just upstream of the tidal marshes. Bald cypress, swamp black gum, and red maple are the dominant tree species (Braun 1967:93; Brush et al. 1980:83) and there are many associated edible aquatic plants. Deer, and many other game animals frequent these swamps and they are highly productive environmental settings for hunters and gatherers. Unfortunately, the antiquity of these swamps and their vegetation history is not well known.

In contrast to the well watered and environmentally diverse riverine areas of southwestern Delaware, the interior is not as well watered. Certainly, the diversity of the tidal wetlands is not found in the interior. However, studies of environmental diversity in the Middle Atlantic Coastal Plain (Brush, Lenk, and Smith 1980; Braun 1967) note the importance of soil drainage in determining environmental composition and there are many large patches of poorly drained soil settings in the interior (Ireland and Matthews 1974). These poorly drained areas are now characterized by woodlands of either deciduous or coniferous species, with the later developmentally older. Common species include willow oak, white oak, sweet gum, red maple, water oak, cow oak, black gum, sweet oak, holly, and dogwood (Braun 1967:268). Thus, the interior, prior to the artificial draining of agricultural fields, was probably at one time a rich mosaic of poorly drained, fresh water swamps and bogs, and well drained sand ridges. The poorly drained woodlands would have been productive settings for hunters and gatherers and would have been attractive settlement locations even though they were not as

productive as the riverine areas. In sum, the study area can be generally characterized as a contrast between the very rich and productive riverine settings which included the oligohaline ecotone and a less rich, but still very productive, interior zone.

Numerous sources of data indicate that there were marked climatic and environmental changes over the past 12,000 years in both riverine and interior areas. Detailed discussions have been presented elsewhere (Custer 1983a:17-24; 1984a:30-37, 44-48, 62-64, 89-93, 154) and only a summary will be presented here. should be noted that there are numerous relevant sources of paleoenvironmental data for Delaware's Low Coastal Plain including the Dill Farm Site (Custer and Griffith 1984), a series of cores from the Nanticoke drainage (Brush 1986), cores from a bay/basin feature near 7NC-H-20 (Custer and Bachman 1986b) and other bay/basin sites (Webb, Newby, and Webb 1988), and a series of cores from the mouth of the Chesapeake Bay (Harrison et al. Table 1 summarizes the changing environments through time and notes their distributions in the riverine and interior portions of the study area. It should also be noted that the productivity of the riverine zone has changed through time as post-Pleistocene sea level rise (Belknap and Kraft 1977) inundated the drainage and pushed tidal and brackish water settings further into the interior along the major drainages. Perusal of Table 1 shows that the basic dichotomy between the riverine and interior areas probably was present for much of the Holocene and was an important factor in historic and prehistoric settlement decisions.

	Т	ABLE 1 -			
PALEOENVIRONMENTS IN THE STUDY AREA					
Episode	Interior Well-Drained	Poorly Drained	Riverine		
Late Glacial (12,000 BC - 6500 BC)	Boreal forest, limited grass- lands	Bogs and swamps with deciduous gallery forest	Deciduous gal- lery forest with some floodplain grasslands		
Pre-Boreal/ Boreal (8000 BC - 6500 BC)	Boreal forest	Bogs and swamps with deciduous gallery forest	Deciduous gal- lery forest and boreal forest		
Atlantic (6500 BC - 3000 BC)	Oak-hemlock mesic decid- uous forest	Extensive bogs and swamps with deciduous gal- lery forest	Mesic decidu- ous forests		
Sub-Boreal (3000 BC - 800 BC)	Oak-hickory- pine xeric forests and grasslands	Few bogs and swamps	Deciduous gal- lery forests with fringing wetlands		
Sub-Atlantic /Recent (800 BC - recent)	Oak-pine forest with mixed mesophytic communities	Bogs and swamps with deciduous gallery forests	Deciduous gal- lery forests with fringing wetlands		

REGIONAL PREHISTORY

The prehistoric archaeological record of the study area, and the Delmarva Peninsula in general, can be divided into four major periods: Paleo-Indian Period (ca. 12,000 B.C. - 6500 B.C.), the Archaic Period (6500 B.C. - 3000 B.C.), the Woodland I Period (3000 B.C. - A.D. 1000), and the Woodland II Period (A.D. 1000 - A.D. 1650). A fifth time period, the Contact Period, may also be considered and includes the time period from A.D. 1650 to A.D. 1750, the approximate date of the final Indian habitation of southern Delaware in anything resembling their pre-European

Contact form. The descriptions of these periods noted below are derived from Custer (1983a; 1983b; 1984a; 1988) and the chronology of these periods is shown in Figure 4.

Paleo-Indian Period (12,000 B.C. - 6500 B.C.). The Paleo-Indian Period encompasses the time period of the final disappearance of Pleistocene glacial conditions from Eastern North America and the establishment of more modern Holocene environments. distinctive feature of the Paleo-Indian Period is an adaptation to the cold, and alternately wet and dry, conditions at the end of the Pleistocene and the beginning of the Holocene. This adaptation was primarily based on hunting and gathering, with hunting providing a large portion of the diet. Hunted animals may have included now extinct megafauna and moose. A mosaic of deciduous, boreal, and grassland environments would have provided a large number of productive habitats for these game animals throughout southern Delaware, and watering areas would have been particularly good hunting settings.

Tool kits of the people who lived at this time are oriented toward the procurement and processing of hunted animal resources. A preference for high quality lithic materials has been noted in the stone tool kits and careful resharpening and maintenance of tools was common. A recent analysis of fluted points (Figure 5) from the Delmarva Peninsula, including some from the study area, shows this preference (Custer 1984b). A lifestyle of movement among the game-attractive environments has been hypothesized with the social organizations being based upon single and multiple family bands. Throughout the 5500 year time span of the period, the basic settlement structure remained relatively

FIGURE 4
Prehistoric Chronology Chart

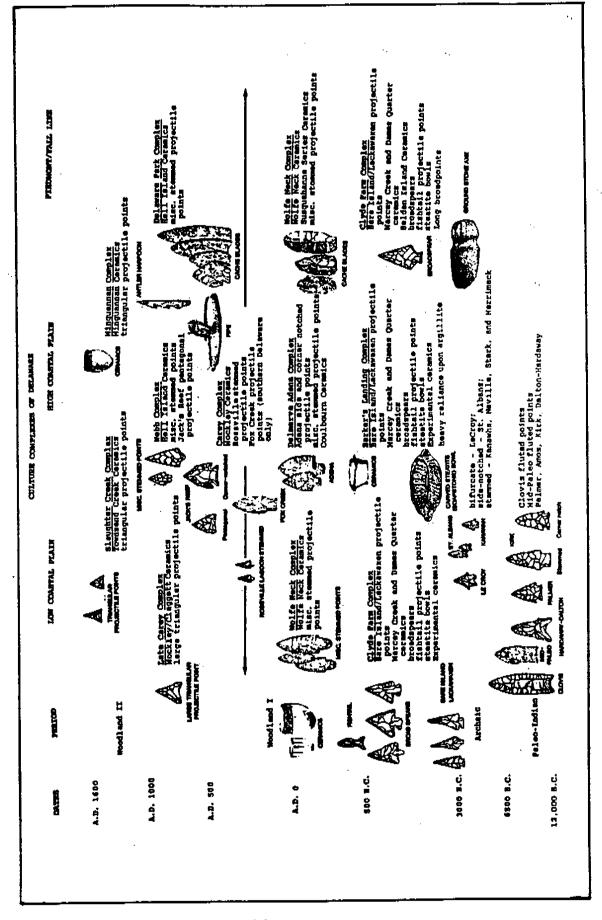
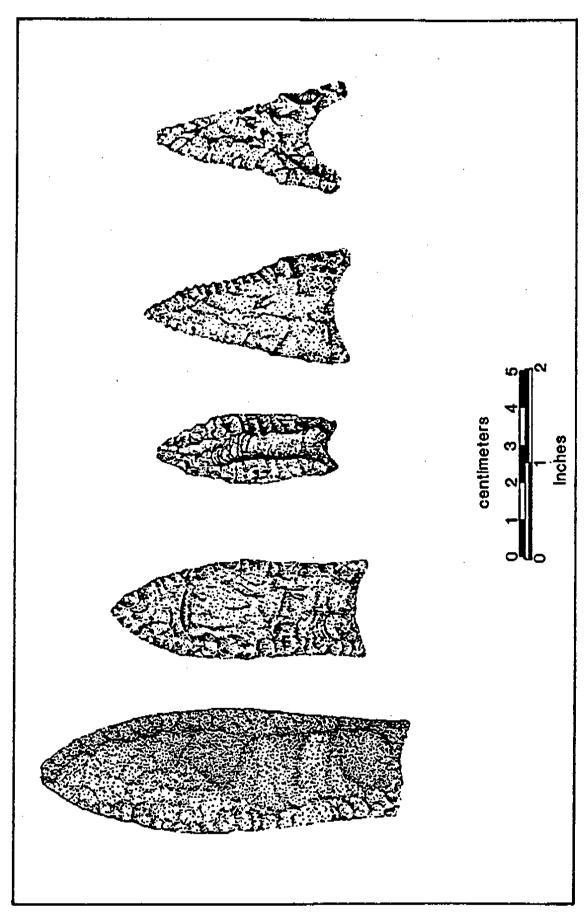


FIGURE 5
Paleo-Indian Fluted Points



period, the basic settlement structure remained relatively constant with some modifications being seen as Holocene environments appeared at the end of the Paleo-Indian Period.

The main types of Paleo-Indian sites known for the study area are base camps, base camp maintenance stations, and hunting sites. The riverine settings of the Nanticoke and its major tributaries would be the expected locations for base camps while poorly drained interior swamps and bogs would be the foci of maintenance and hunting sites.

Archaic Period (6500 B.C. - 3000 B.C.). The Archaic Period is characterized by a series of adaptations to the newly emerged full Holocene environments. These environments differed from earlier ones and were dominated by mesic forests of hemlock and oak. A reduction in open grasslands in the face of warm and wet conditions caused the extinction of many of the grazing animals hunted during Paleo-Indian times; however, browsing species such as deer flourished. Adaptations changed from the hunting focus of the Paleo-Indians to a more generalized foraging pattern in which plant food resources would have played a more important role.

Tool kits were more generalized than earlier Paleo-Indian tool kits (Figure 6) and showed a wider array of plant processing tools such as grinding stones, mortars, and pestles. A mobile lifestyle was probably common with a wide range of resources and settings utilized on a seasonal basis. A shifting band-level organization which saw the seasonal waxing and waning of group size in relation to resource availability is evident. A recent study of Archaic site distributions on the Delmarva Peninsula

5 centimeters 2 inches

FIGURE 6 Archaic Period Points

(Custer 1986a) indicates that although there were changes in adaptations between the Paleo-Indian and Archaic time periods, the basic site location patterns remained the same.

woodland I Period (3000 B.C. - A.D. 1000). The Woodland I Period can be correlated with a dramatic change in local climates and environments that seems to have been a part of events occurring throughout the Middle Atlantic region. A pronounced warm and dry period set in and lasted from ca. 3000 B.C. to 1000 B.C. Mesic hemlock-oak forests were replaced by xeric forests of oak and hickory, and grasslands again became common. Some interior streams dried up, but the overall effect of the environmental changes was an alteration of the environment, not a degradation. Continued sea level rise created extensive brackish water marshes which were especially high in productivity throughout much of southern Delaware.

The major changes in environment and resource distributions caused a radical shift in adaptations for prehistoric groups. Important areas for settlements included the major river floodplains and estuarine areas. Many large base camps with fairly large numbers of people are evident in many parts of the Delmarva Peninsula. These sites supported many more people than earlier base camp sites and may have been occupied nearly throughout the year. The overall tendency was toward a more sedentary lifestyle with increases in local population densities.

Woodland I tool kits show some minor variations as well as some major additions from previous Archaic tool kits. Plant processing tools became increasingly common as would be expected

in the face of an intensive harvesting of wild plant foods that may have approached the efficiency of horticulture by the end of the Woodland I Period. Chipped stone tools changed little from the preceding Archaic Period; however, more broad-bladed knife-like processing tools became prevalent (Figures 7 and 8). Also, the presence of a number of non-local lithic raw materials indicates that trade and exchange systems with other groups were beginning to develop (Custer 1984c). The addition of stone, and then ceramic, containers is also seen. These items allowed more efficient cooking of certain types of food and may also have functioned as storage containers for surplus food resources.

Social organizations also seem to have undergone radical changes during this period. With the onset of relatively sedentary lifestyles and intensified food production, which might have produced occasional surpluses, incipient ranked societies began to develop (Custer 1982). One indication of these early ranked societies is the presence of extensive trade and exchange and some caching of special artifact forms.

Woodland II Period (A.D. 1000 - A.D. 1650). In many areas of the Middle Atlantic, the Woodland II Period is marked by the appearance of agricultural food production systems and large-scale village life (Custer 1986b). In southern Delaware, however, the change in lifeways is not as marked. There have been some finds of cultivated plants in southern Delaware (Custer 1984a:165; Doms et al. 1985), but cultivated food remains are far less common than wild, gathered plant foods (Custer and Griffith 1986:44-49). In general, the Woodland II subsistence

FIGURE 7 Woodland | Projectile Points

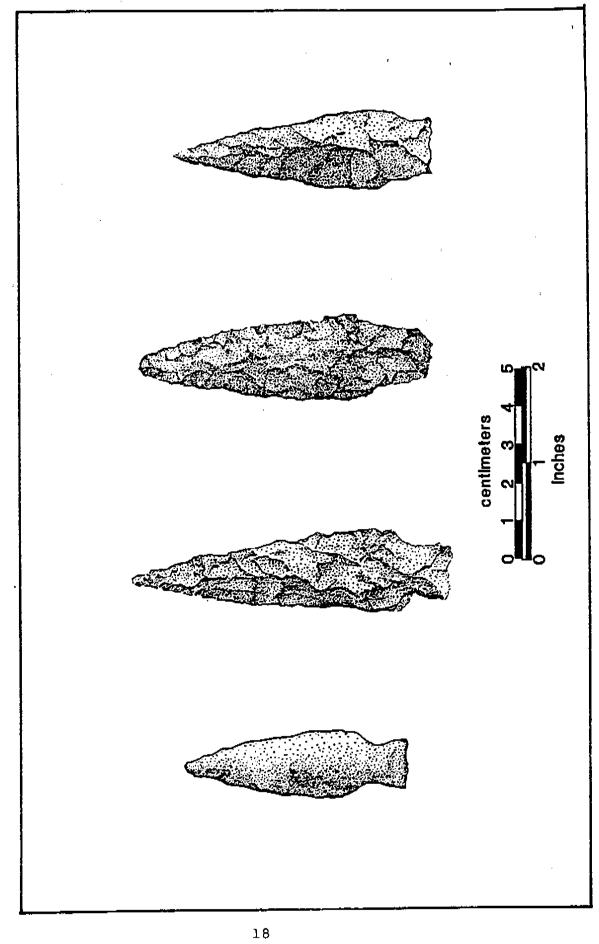
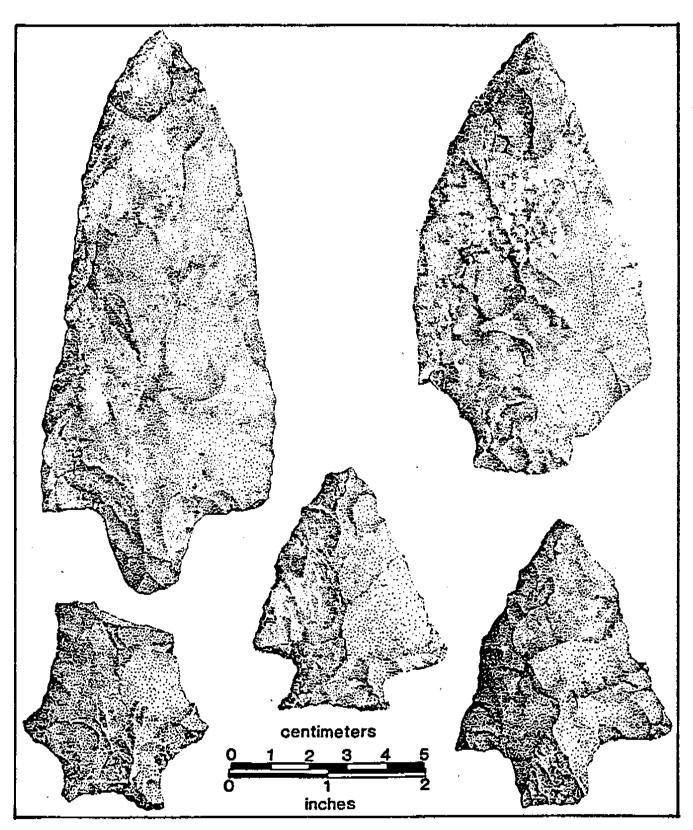


FIGURE 8 Woodland I Broadspears



patterns in southern Delaware are similar to those of the Woodland I Period with the likely addition of minor amounts of cultivated plant food resources.

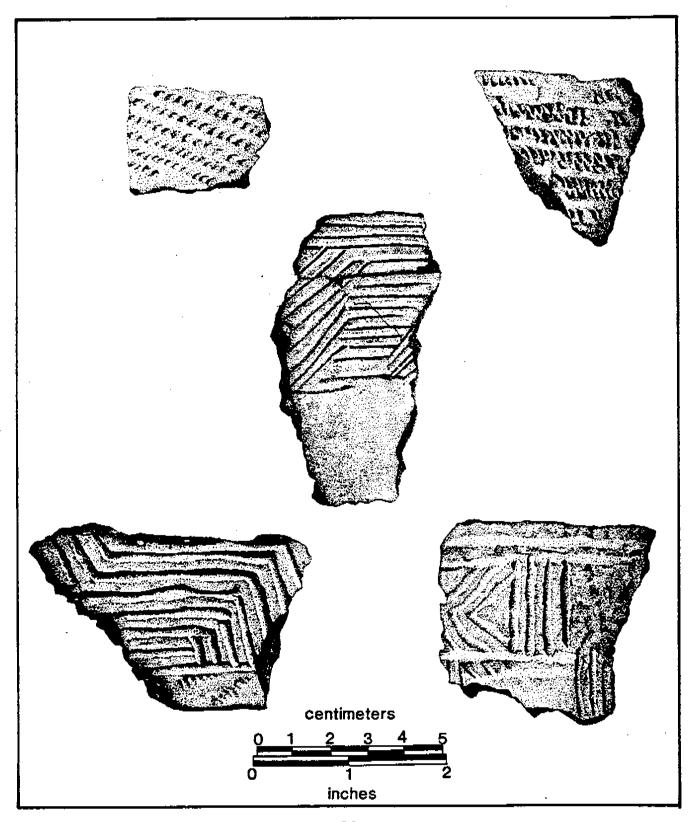
Changes in ceramic technologies and projectile point styles can be used to recognize archaeological sites from the Woodland II Period. Triangular projectile points (Figure 9) appeared in stone tool kits immediately before the beginning of the Woodland II Period and by A.D. 1000, triangular projectile points are the only styles seen in prehistoric tool kits. Woodland II ceramics of southern Delaware are classified within the Townsend series (Griffith 1982) and show certain technological similarities with the preceding Woodland I ceramics. However, the appearance of more complex decorations including incised lines and cord-wrapped stick impressions distinguish the Townsend ceramic styles (Figure 10).

Contact Period (A.D. 1650 - A.D. 1750). The Contact Period is an enigmatic portion of the archaeological record of southern Delaware which began with the arrival of the first substantial numbers of Europeans in Delaware. The time period is enigmatic because only one Native American archaeological site that clearly dates to this period has yet been discovered in Delaware (7NC-E-42 - Custer and Watson 1985). In southern Delaware, Contact occupations have been reported for the Townsend Site (Omwake and Stewart 1963); however, the associations of European and Native American artifacts are problematic (Custer 1984a:177). Nevertheless, numerous Contact Period sites are evident in southeastern Pennsylvania and on the Maryland Eastern Shore

FIGURE 9
Woodland II Projectile Points centimeters

21

FIGURE 10 Townsend Ceramic Sherds



(Davidson 1982; McNamara 1985; Davidson, Hughes, and McNamara 1985). It seems clear that the Native American groups of Delaware did not participate in much interaction with Europeans and were under the virtual domination of the Susquehannock Indians of southern Lancaster County, Pennsylvania, who lived during the same time period (Kent 1984). The Contact Period ended with the virtual extinction of Native American lifeways in the Middle Atlantic area except for a few remnant groups.

REGIONAL HISTORY

The following regional historical summary is presented to provide a brief background on important local and regional historical events that shaped and affected the inhabitants of Sussex County. The historical periodization is obtained from the State Historical Plan (Ames et al. 1987; Herman and Siders 1986), and descriptions of regional historical events are based on the works of Munroe (1978, 1984), Hoffecker (1977), and Scharf (1888).

1630 to 1730: Exploration and Frontier Settlement

The earliest colonial settlement in Delaware, known as Swanendael ("valley of swans"), was made at present Lewes, Sussex County in 1631 under the sponsoring of the patroons of the Dutch West India Company for the purpose of whaling and raising grain and tobacco. This venture was privately financed, but it ended in tragedy when the all-male population was wiped out in a massacre by the local Indians, the Sickoneysincks, in 1632. Farther north a group of Swedes in the employ of the New Sweden Company built Fort Christina in 1638 in what is now part of the

present City of Wilmington. Fort Christina thus became the first permanent European settlement in Delaware. The Swedish government supported the venture, and Fort Christina, located at the confluence of the Brandywine and Christiana Creeks, became the nucleus of a scattered settlement of Swedish and Finnish farmers and traders known as New Sweden (Weslager 1987).

The Dutch claimed the identical land -- from the Schuykill River south -- by right of prior discovery, and in 1651 the West India Company retaliated by building Fort Casimir at the present site of New Castle, in an attempt to block Swedish efforts to control commerce on the Delaware River. The Swedes responded by capturing this fort in 1654 and renamed it Fort Trinity. Rivalry between the Swedes and the Dutch continued, and the Dutch returned to the Delaware Valley in 1655 with a large military force and recaptured Fort Trinity and also seized Fort Christina. As a result, New Sweden ceased to exist as a political entity due to a lack of support from the homeland. Nonetheless, Swedish and Finnish families continued to observe their own customs and religion.

In 1657, as a result of peaceful negotiations, the City of Amsterdam acquired Fort Casimir from the West India Company, and founded the town in the environs of the fort called New Amstel. This was a unique situation in American colonial history -- a European city became responsible for the governance of an American colony. The Dutch erected a small fort at Lewes, called the Whorekil [also spelled Hoerenkil, Horekill, Horekill, and Hoorekill], near the mouth of the Delaware Bay in 1659 for the purpose of blocking English incursions, particularly settlers

from the Chesapeake Bay and Virginia, since Lord Baltimore considered the lands on the eastern shore of the Chesapeake Bay and extending to the western shore of the Delaware as part of his Proprietorship. At the Whorekil (Lewes) several Dutch families built homes, including Dutch Mennonites under the leadership of Cornelius Plockhoy, who established a semi-socialistic community there in July of 1663. They too, were under the supervision of local officials appointed by the burgomasters of Amsterdam.

English hegemony of the Delaware River and Bay area began in 1664 when Sir Robert Carr attacked the Dutch settlement at New Amstel on behalf of James Stuart, Duke of York, brother of Charles the II. This was an important move on the part of England to secure her economic position in the New World. The settlement at the Whorekil was also seized and pillaged by the English.

A transfer of political authority from the Dutch to the English then followed, and the Dutch settlers who swore allegiance to the English were allowed to retain their lands and personal properties with all the rights of Englishmen. Former Dutch magistrates continued in office under the Duke of York's authority, and the Swedes, Finns, and Dutch alike peacefully accepted the rule of the Duke of York through his appointed governors. In 1670 the first local court was established at the Whorekil by Governor Lovelace. By 1671 the population of the Whorekil consisted of forty-seven individuals, both Dutch and English (Gehring 1977:100). It was reported at that time that the Marylanders were unlawfully settling within the boundaries of

the Duke of York's lands, specifically about 20 miles from the Whorekil in the vicinity of Assawoman Inlet. Indeed, in 1670 Lord Baltimore had created a new county, called Durham, which encompassed all of the lands presently occupied by much of the State of Delaware (Papenfuse and Coale 1982:11). Between 1670 and 1682, when William Penn became the Proprietor of the lands from the Whorekil to New Castle, Baltimore issued at least 45 warrants for lands on the west side of the Delaware Bay, along "Duke Creek" (probably Duck Creek), Slaughter Creek, Prime Hook, Indian River, and Whorekil Creek (Skirven 1930). In 1673, during the third Anglo-Dutch War, the Dutch recaptured New Netherlands, including New Amstel and the Whorekil. The Dutch retained possession of the region only briefly, returning the lands to the English in 1674 in exchange for the captured Dutch colony of Surinam. The short war had an effect on the settlers at the head of Delaware Bay, however, for in December of 1673, the Maryland government sent an expeditionary force of forty men to the Whorekil, which was burned and pillaged for a second time in less than a decade (devalinger 1950). Following the peace treaty, the English again regained control of the region.

In 1682, the granting of proprietary rights to William Penn and his representatives by the Duke of York essentially gave political and economic control of the Delaware region to Philadelphia, the new seat of government in Penn's colony of Pennsylvania (Munroe 1978). Two years earlier, in 1680, Governor Edmund Andros had established the County of Deale, which included the settlements at the Whorekil northwards to Cedar Creek. The settlement of the Whorekil region, particularly around the town

of Whorekil, and the area ten miles south at Indian River and Assawoman Inlet, was encouraged by Governor Andros. Between 1676 and 1678 forty-seven land patents were issued by the Duke of York's government for lands in the area, all fronting on the coast or on navigable streams and rivers (Hancock 1976:17).

With Penn's arrival in 1682, the name of Deale County was again changed, this time to Sussex County, and the name of the town of Whorekil was changed to Lewes, the county seat of the English county of Sussex. In 1682 the first surveyors of highways and bridges were appointed for the county. County at this time was heavily forested and swampy, and settlement in the county for much of this period was confined to an area within about 10 to 12 miles of the coastline, extending inland along a line running roughly from modern Milford-Milton-Harbeson-Millsboro-Dagsboro. Grist mills were established on Broadkiln creek (Milton) by 1695 and on Bundick's Branch soon thereafter; an earlier grist mill had existed in Lewes by 1676. Lewes was the only town of any size in the county, and it became a political, maritime, and commercial center for the region, and Anglican, Presbyterian and Quaker houses of worship were established in the town by the end of this period. A second Presbyterian Church, the Cool Springs Meeting House, was erected about six miles west of Lewes on Cool Spring Branch by 1728. Yards for ship building were present in Lewes by the early 1680s (Hancock 1976:21). The population of Sussex County has been estimated to have been less than 1000 persons by 1700, and the majority of these inhabitants were farmers, raising crops of tobacco (the primary medium of exchange), corn, wheat, and rve.

Hogs and cattle were also raised. The exporting of cattle, by driving them overland from Lewes to New Castle, appears from the records to have been a significant source of income for the settlers of Sussex (Munroe 1978:198).

Political relations between the Three Lower Counties and Pennsylvania deteriorated and by 1704 representatives from Sussex County began to meet with legislators from New Castle and Kent Counties in a seperate assembly at the Town of New Castle, but the Governor continued to be appointed by Pennsylvania. Economic and social ties, however, continued to link the Lower Counties with Philadelphia throughout the seventeenth and eighteenth centuries (Munroe 1954).

1730 to 1770: Intensified and Durable Occupation

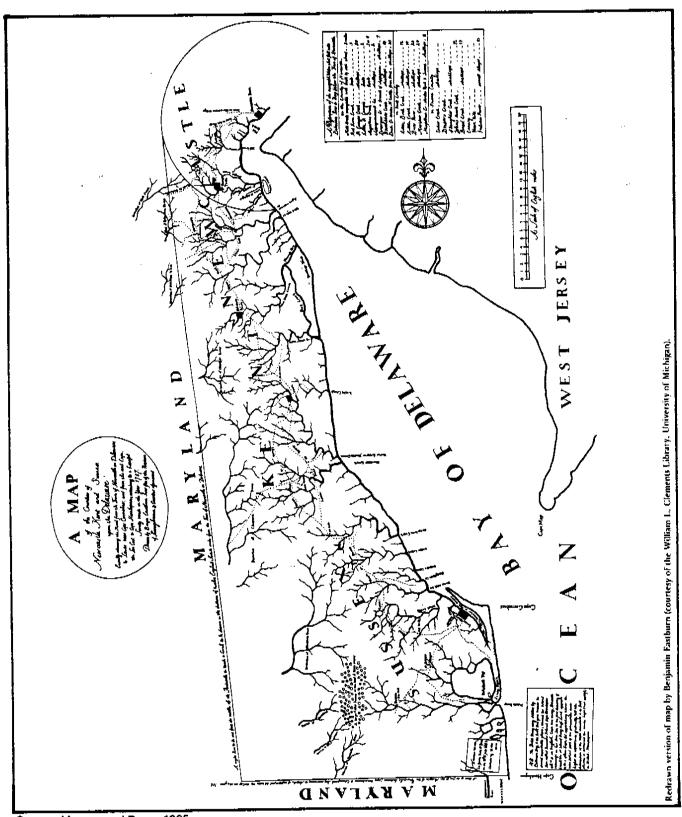
Settlement in Sussex County by the start of this period had penetrated the interior portions of the region, reaching the area of the mid-penisular divide (just to the west of present-day Georgetown). Patents for land west of the headwaters of the Broadkiln and Indian rivers, and along Gravelly Branch and its tributaries were being issued from the Pennsylvania government by the second decade of the eighteenth century (Scharf 1888:1237, 1293). According to one contemporary observer

The Inhabitants here live scattering generally at 1/2 a mile or miles distance from each other, except in Lewes where 58 families are settled together. The business or Employment of the Country Planters, is almost the same with that of an English Farmer, they commonly raise Wheat, Rye, Indian Corn, and Tobacco, and have Store of Horses, Cows, and Hoggs. The produce they raise is commonly sent to Philadelphia ... The people here have generally the Reputation of being more Industrious then they of some of the Neighboring Counties (Hancock 1962:139).

On the opposite side of the Peninsula, in the area that would become Northwest Fork, Nanticoke, and Seaford Hundreds, the Maryland government was issuing patents and warrants as early as the 1680s for lands on the Marshyhope Creek, Clear Brook Branch, and other tributaries of the northwest fork of the Nanticoke In 1682 John Nutter of Maryland took up the tract of land between Clear Brook Branch and Bridge branch that would eventually contain the town of Bridgeville (Hancock 1985:13). Other prominent family names from the western part of Sussex County, such as Cannon, Polk, Richards and Adams, appeared in the area during this period under Maryland land patents. settling of the dispute over the boundary line between Maryland and Pennsylvania (including the Three Lower Counties) in 1765 by the establishment of the Mason-Dixon Line, the traditional western boundary between Sussex County and Worcester County was the Nanticoke River and its tributaries, particularly Tussocky Branch and Gravelly Branch. Those settlers on the west side of the Nanticoke resided in the Province of Maryland, and those on the east side lived in Sussex County. Needless to say, this rather arbitrary boundary caused considerable confusion and dissention among the "Border People" on the Peninsula, and numerous annoying disturbances occurred along the borders of New Castle, Kent, and Sussex counties throughout the period.

For most of the eighteenth century, the land remained heavily wooded and overland passage was difficult. The limited extent and development of the road network in the county is shown on Benjamin Eastburn's map of the Lower Counties in 1737 (Figure 11). Major roads included the King's Highway, officially

"A Map of the Counties of New Castle, Kent, and Sussex upon the Delaware", by Benjamin Eastburn (1737)



established by an Act of the General Assembly in 1752, which ran northwards from Lewes to Cedar Creek and St. Mathews Anglican Church (built in 1707), and from there to Dover and up country to Wilmington (Laws of the State of Delaware 1797:320, 390-394). From Lewes the main road ran south through St. Georges Chapel to Warwick and the ferry crossing on the Indian River, Lewes southeast down the Atlantic Coast towards the Inlet. St. Georges Chapel (built in 1719), a side road extended down Angola Neck, a site of early settlement in the county (Munroe and Dann 1985). In the western part of the county, claimed at this time by Maryland, a major overland route ran from Choptank Bridge across Gravelly Branch in the vicinity of Coverdale Crossroads. The roads were described at the beginning of this period as "very commodious for travelling, the land being level and generally sandy, so that the people usually come to Church Winter and Summer some 7 or 8 miles, and others 12 or 14 miles...."(Hancock 1962:140).

The population of Sussex County grew slowly throughout this period. In 1728, The Reverend William Beckett reported that there were a total of 1,750 inhabitants in the county, consisting of 1,075 Anglicans, 600 Presbyterians, and 75 Quakers. Beckett also noted that there were 241 slaves and free blacks in the county. The presence of so many Presbyterians, Beckett said, was due to the great influx of at that time of Scotch-Irish settlers "of the most bigotted sort" (Hancock 1962:138). By the 1740s, it was estimated that the population of Sussex County was between 1,800 and 2,000 (Pennsylvania Archives 1891), and Hancock (1976:26) estimates that by 1775 there were nearly 14,000

inhabitants. The tremendous growth of the population between 1740 and 1775 may be attributable to the strong migration of settlers from the eastern shore of Maryland to Delaware lands, as well as to overseas immigration from Great Britain (Munroe 1978:150).

Throughout the period, farming continued to be the major occupation of the settlers in Sussex. The farms and plantations in Sussex have been generally characterized as subsistence farms, operated by poorer farmers and farm laborers, particularly when compared to the farms located in New Castle County (Main 1973:26-32). Tobacco declined from its position as the prominent cash crop in Kent and Sussex counties, and was replaced somewhat by corn and wheat. The lumber industry, particularly the harvesting of vast stands of cedar and pine from the Indian River area, began in this period to grow in importance, and the shellfish industry was established in the bays of Sussex. Shipbuilding remained a significant industry, especially at Lewes, on the Broadkiln, and along Indian River.

An important industry that flourished in the county during this time period was the iron industry. Several iron furnaces and plantations were established along the Nanticoke, Gravelly Branch, and Deep Creek beginning in the 1760s (Tunnell 1954; Heite 1974). These furnaces used bog iron ore, dug from the surrounding swamps and wetlands, for their sources of ore. The Deep Creek Furnace was established in 1763, as was Nanticoke Forge, located at Middleford. Pine Grove Furnace was located at the present site of Concord, and the Unity Forge (blast furnace),

owned by Joseph and Samuel Shankland, was located at the Head of the Nanticoke River in Northwest Fork Hundred. Most of these furnaces were out of production by the beginning of the American Revolution.

Lewes continued to be the major town in the region, though there was some dissention in the 1760s among the inhabitants of the southern and western portions of the county to have the county seat moved to the Crossroads on the Broadkiln (present-day Milton). Several small hamlets began to spring up during this time period, mostly located at stream and river crossing points. Besides the Crossroads, also known as Clowes, these hamlets included Bridgebranch (later Bridgeville) in Northwest Fork Hundred, established in 1730 with the erection of a bridge over the creek of the same name; Warwick in Indian River Hundred, a ferry-point erected before 1750 on the upper reaches of Indian River; and St. Johnstown in Nanticoke Hundred, the location of crossroads village and Presbyterian Church in the last quarter of the eighteenth century.

1770 to 1830: Transformation from Colony to State

By the start of this period, the century-long boundary dispute between Maryland and Pennsylvania had been decided, and the area west of the Nanticoke offically became part of Sussex County. The addition of such a substantial tract of land spurred the creation of five new hundreds in Sussex; Baltimore, Little Creek, Dagsborough, Nanticoke, and Broad Creek. These hundreds in "New Sussex" were joined with the five hundreds of "Old Sussex; Lewes and Rehoboth, Indian River, Northwest Fork, Broadkill, and Cedar Creek (Hancock 1976:25) (Figure 12). Sussex

FIGURE 12
Delaware Map of Hundreds, c1700-c1800

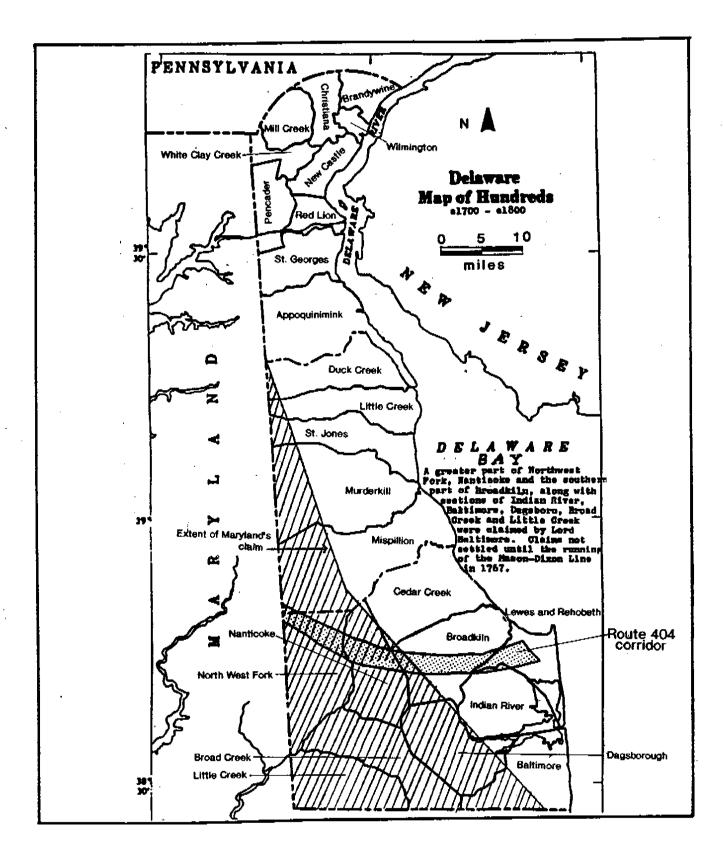


TABLE 2← POPULATION OF SUSSEX COUNTY, 1800 Hundred TNWM TNWF TWP NOFP, NT NS TP PS Cedar Creek 15.2% Broadkiln 9.9% Nanticoke 13% Northwest Fork 18% Little Creek 11.8% Broad Creek 13% Baltimore 18.3% Lewes and Rehoboth 15.8% Dagsborough 19% Indian River 15.5% Total 15,224 2830 19,322

KEY:

TNWM = Total Number of White Males, all Ages
TNWF = Total Number of White Females, all Ages

TWP = Total White Population

NOFP,NT = Number of Other Free Persons, Not Taxed

NS = Number of Slaves
TP = Total Population
PS = Percent of Slaves

*From Return of the Whole No. of Persons within the Several Districts of the United States, 2nd Census of the U.S., Duane, Washington, D.C.

County thus became the largest of the Three Lower Counties, with a surface area of 94 square miles, nearly the size of both New Castle and Kent counties combined. By 1800 the population of the county was 19,358 inhabitants, with nearly 40% of the total located in the hundreds of Northwest Fork, Nanticoke, and Broadkill. The largest slaveholding hundreds at this time were Northwest Fork, Baltimore and Dagsborough, each with between 18% and 19% slaves in their respective populations (Table 2).

At the start of this period, the American Revolution dominated the social and political scene in the county. Much of the effects of the war were limited to the coastal areas around

Lewes, the Mispillion, Broadkill, and Indian rivers, where British blockades and shore raids disrupted trade and commerce. Inland, however, strong loyalist sentiments among the population prevailed, and in 1780 about 400 Tories took part in the Black Camp Rebellion. The headquarters of the rebellion was located in a swamp about six miles north of Georgetown, and was quelled with the use of Kent County militia (Hancock 1976:43). Many of the participants in the rebellion were inhabitants of the poorer regions of the county, and complained about a lack of paper currency, and of destitution for their families. Economic grievances of this sort would continue after the Revolution, and throughout the period.

In 1791, the Sussex County legislature voted to move the county seat from Lewes to the new town of Georgetown, located near the center of the county. As a result of this move, improvements in the transportation network, particularly in the interior parts of the county, were undertaken. By 1796 a road running south from Georgetown to Laurel was established, as was a road from Georgetown north to Milton and the Broadkill (Sussex County Road Papers 1792, 1796). Within the project area, both the transportation network and the settlement pattern focused on grist mills, saw mills, and mill dams. The mills provided nodal points for the surrounding population, and other services, such as taverns, shops, and stores were erected in their vicinities. The mill dams often provided the easiest means of crossing low, swampy ground and of crossing the mill ponds, thus becoming ready-made causeways across streams and creeks in the area. The

mills located at Collins Pond, Hunter's Pond, and Red Mill Pond are examples of this settlement pattern, as are the roads which cross at their dams.

Mill seats sometimes expanded into larger towns, such as Laurel (1802), Millsboro (1792), and Dagsboro (circa 1780). Other small towns grew up around crossroads and fords, such as Seaford (1799) and Bridgeville (renamed in 1810), and ship building provided the impetus for the growth of Bethel (1800) and Milton (1807).

Beginning in 1779 the Sussex Legislature passed several "Ditch Acts" in an effort to reclaim swampy or low ground so that it would be suitable for agricultural use. Between 1779 and 1812 over thirty ditch acts were passed, and these effected such drainages as the Marshyhope, Indian Run, Pot Hook Creek, and Almshouse Ditch. The reclamation of land in this fashion would be a continuing operation in Sussex, and today is represented by County Tax Ditches. By 1976 there were 106 independent tax ditch companies in Sussex (Passmore 1978:19).

Corn agriculture predominated throughout this period in Sussex County, and in the southern part of the county livestock raising contributed substantially to the economy (Macintyre 1986; Michel 1985; Garrison 1988). Homesteads in Sussex were generally characterized by a frame or log 1 and 1/2 story house averaging under 450 square feet of living space, a small orchard of apple and peach trees, and usually about four outbuildings, including a corn barn, smoke or meat house, and kitchen. Livestock on the farm might include a herd of hogs, cows, sheep, oxen, and an occassional horse. On most plantations, only 50% of the total

acreage of the farm was under cultivation (Hancock 1987:24-25). "Out plantations" or "out fields" might be located close by the farm, and were locations of tenant houses or well-used fields. A form of extensive subsistence farming coupled with home manufacturing dominated the economy of Sussex County during this Tench Coxe (1814:76), in his report on the manufactures of the United States for the year 1810, indicated that over 70% of the looms in the state of Delaware were located in Sussex County. Over 62% of the total value of flaxen goods, and over 75% of the wool produced in Delaware, came from homes in Sussex County. Coxe also reported that the five iron forges in the state were located exclusively in Sussex and produced 215 tons of iron annually. Twenty distilleries in the county produced nearly half of the annual value of all of those establishments in the Other categories of manufacturing, like grist mills, state. fulling mills, cotton and woolen factories, and snuff mills, were located predominantly in the industrial counties of Kent and New Castle (Table 3).

Though the demise of the iron furnaces of western Sussex County occurred at the start of this period, they were replaced by bloomery forges, which were smaller and more economical to maintain. The forge at Collins Mill Pond and the Unity Forge near Bridgeville are examples of these types of forges (Heite 1974).

1830-1880: Industrialization and Capitalization

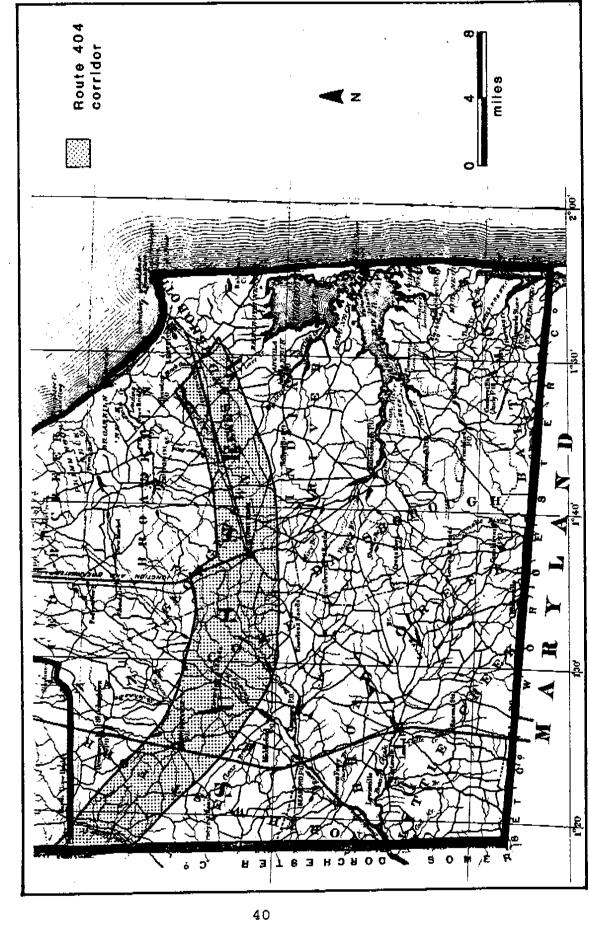
The most significant event to occur within the county during this period was the arrival of the railroad (Figure 13). Prior

—— ТАВLЕ 3 —— CENSUS OF MANUFACTURES IN DELAWARE, 1810 Category Counties New Castle Kent Sussex Total Values Textiles: No. of cotton 3 manufactures Cotton (yds) made in families 661 661 yds \$ Woolen manufactures 2 Woolen (yds) made in families 1,524 4,269 48,150 63,943 \$ 63,943 167 No. of looms 200 1,638 2,005 10 Carding machines Flaxen goods (yds) Plaxen goods (yds)
made in families 75,440 38,427 166,502 280,369 yds \$132,640 Iron: Forges 5 \$ 23,220 (215 tons) Naileries 1 Tanneries: No. of manufactures 10 12 25 - 14,330 Pounds tanned 14,330 hides and skins tanned 16,180 16,000 32,180 Value of the above \$56,405 \$52,000 \$ 2,866 \$111,271 Distilleries No. of manufactures 19 12 20 51 Value of Distilleries \$ 5,400 \$ 2,880 \$ 7,200 \$ 15,400 No. of Breweries 2 Mills: No. of paper mills No. of snuff mills No. of rope walks 2 2 No. of gunpowder mills No. of salt works 7 2,050 No. of grist mills 27 15 42 No. of barley mills 2 KEY: No. = Number

Yds = Yards

*From Tench Coxe, A Statement of the Arts and Manufactures of the United States for the Year 1810. A. Cornman, Jr., Philadelphia 1814, p. 76.

Detail of Sussex County, from D.G. Beers' Atlas of the State of Delaware (1868) FIGURE 13



to this time, the preferred method of long-distance travel out of the county had been by steamboat, since overland travel was hampered by poor roads. Constructed in the western portion of the county, the Delaware Railroad reached the town of Seaford in 1856, and exited the state at Delmar by 1859 (Hancock 1976:63). The Delaware, Maryland and Virginia Railroad ran from Harrington to Milford, and from Milford south to Georgetown in 1869 (LeeDecker et al. 1989:32). A third line, the Junction and Breakwater Railroad was constructed between 1859 and 1868, when it reached Lewes; a spur line eventually connected to Rehoboth in 1878 (Hancock 1976:89).

The arrival of the railroad in the county stimulated changes in agriculture and industry, and the growth of new towns. The growing of perishable market crops, particularly fruits like peaches, blackberries and strawberries, became possible after the railroad. By the end of this period, Sussex County was the leading peach producing area of Delaware, and most of this crop was shipped by rail or water to urban locations. The transportation of the fruit crops was made possible in turn by the establishment of canneries, like the Fruit Preserving Company and the Georgetown Packing Company, both constructed near the railroad depot in Georgetown by the mid-1870s (Scharf 1888:1241). Other towns, such as Milton and Bridgeville, also constructed packing companies at this time (Hancock 1976:88).

Town growth was also spurred by the railroad, and depot towns of Lincoln, Ellendale, and Greenwood were established as direct results of the passage of the railroad. These towns were laid out on gridded patterns of streets utilizing the rail line as the primary axis, and were a departure from the layouts of the earlier towns in the region. Smaller cross-roads hamlets, such as Harbeson (started in 1869) and Bennum, sprang up at the railroad stations on the Junction and Breakwater Railroad between Georgetown and Lewes (Eckman 1955:494).

The arrival of the railroad allowed the tourism industry to grow in the county during this time period. Beaches and coastal areas had always held a special allure to the region's inhabitants, and with the improved transportation methods these areas became more accessible to the urban populations of Philadelphia and Baltimore, who no longer had to rely soley on the steamboat to travel to Lewes. The Rehoboth Beach Camp Meeting was organized by the Methodists in 1873, and the Hotel Henlopen, with 75 rooms, was constructed in 1879 (Hancock 1976:90).

At the outbreak of the Civil War, Sussex County was the largest slaveholding area in Delaware, containing over half of the state's slave population. The vast majority of these bondsmen were the property of small farmers, and worked as domestic servants or field laborers. Free blacks in the county generally owned little land, and like their enslaved conterparts, worked as day laborers and hired farm hands, though some were skilled artisans. As in the rest of Delaware, blacks were denied the opportunity of education, were not permitted to own firearms, and had their freedom severely circumscribed by laws (Hancock 1976:65). The end of the Civil War and the emancipation of the slaves in Sussex, though providing freedom, did little to improve

their social or economic status. Several small black communities sprang up at the end of this period, notably the villages of Belltown (started in the 1840s) and Jimtown in Lewes and Rehoboth Hundred (Eckman 1955:494).

During the Civil War, Southern sympathies and leanings were strong in the county, particularly in the southern and western hundreds. In Broad Creek Hundred the inhabitants openly celebrated Confederate victories, and the town of Seaford was notorious for it's role as an illicit trade center with the south. For the most part, however, the population of the county was pro-Union, or at best neutral, and Sussex's economy did well during the War due to high grain prices and renewed construction activities at the local shipyards (Hancock 1976:89).

As in the previous historical periods described above, corn agriculture continued to dominate the Sussex County. The corn that was raised was used to feed livestock, and the small livestock herds of Sussex County were the chief source of agricultural income for the area's farmers. Home manufactures also continued to be a major source of income in Sussex. Long after few New Castle County or Kent County farmers produced any home manufactures, between 50 and 85% of the Sussex County farmers reported it as a source of income in the 1849 Census Schedule. The majority of Sussex inhabitants have been characterized as self-reliant, and often in addition to farming used smithing, carpentry, fishing, milling, tanning, hunting and trapping as suppliments to their incomes (Michel 1985:10-12; Garrison 1988).

Industrialization in the county still lagged behind that seen in New Castle and Kent counties. By 1860 there were a total of 141 manufacturers of all kinds located in the county, including thirty-seven grist mills, fifty-six lumber mills, fifteen blacksmith shops, and six shipyards in Sussex, with smaller numbers of boot and shoe manufacturers, leather works, agricultural implement shops, fisheries, wagon and carriage shops (U.S. Census of Manufactures 1865:54). The majority of these industries were oriented towards intra-county services, though shipbuilding touched all areas of the Delaware and Chesapeake Bays, with ships constructed at Seaford and Laurel, as well as Milton and Lewes, and the lumber industry was nationally known. By the end of this period shipbuilding in villages like Milton had reached its peak (Eckman 1955:416), and the number of flour and grist mills, though still important in the County, had declined to twenty-six (Passmore 1978:24).

1880-1980: Suburbanization

Trends in agriculture begun in the preceeding periods continued in Sussex County, and the county remains the most important agricultural section of the state. At the start of this period corn was still dominant as a cash crop, the county producing over 1,676,000 bushels in 1900. Today corn and soybeans, both used for feed in the broiler industry, are primary products of the county, and Sussex is characterized by a "broiler-corn-soybean complex". Several large-scale agribusinesses, such as the Newtons and Cannons of Bridgeville, and the Townsends of eastern Sussex, dominate the agricultural

ecomomy of the county (Munroe 1984:233; Hancock 1976:100-101). The trends in truck farming and market gardening, started in the 1870s, saw their zenith by 1890, when Sussex became the peach producing center of the State. By 1900 over 7 million quarts of strawberries were grown in the county, making Sussex the leading producer in the nation (Hancock 1976:89). By the early 1960s, however, the orchard crops had been supplanted by other, more lucrative, agricultural products.

The holly wreath industry flourished in Sussex from the 1880s until the 1960s, and many farmers supplemented their incomes during the months of November and December in the holly business. It was an especially significant industry during the Depression, and in 1936 over 2 million wreaths were shipped from the towns of Bridgeville, Milton, Millsboro, and Selbyville. The industry declined quickly after the Second World War (Eckman 1955:385; Hancock 1976:102).

At the start of the twentieth century, the lumber industry was a significant source of income for Sussex County. In 1909 a record amount of timber, over 55 million cubic feet, was shipped from the county. Most of this was virgin Sussex pine which had grown following the initial cuttings caused by the arrival of the railroad several generations earlier. Along with lumbering, the charcoal industry was an important related industry of the county; some charcoal was still being produced in the Redden area as late as the 1950s (Passmore 1978:13,14).

The county also experimented with new agricultural methods, most notably in the chicken industry (broilers, or chickens

weighing under three pounds). In 1923 Mrs. Wilmer Steele, a farmer in Ocean View, raised chickens for profit to be sold in the urban markets for broiling, frying, and roasting. She was extremely successful; the number of broilers raised in Delaware grew from 7 million in 1934 to 54 million in 1942, or over one-quarter of the entire commercial broiler production in the country (Munroe 1984:214-215). By 1944 sixty million broilers were being raised annually, mostly in the southeastern portion of the county in the vicinity of Millsboro and Selbyville. By 1969 Sussex farmers were deriving over 80 million dollars per year income from this source, and its associated agricultural jobs of soybean and feed production (Hancock 1976:99-101). "Thanks to broilers, Sussex became one of the richest agricultural counties in the eastern United States" (Munroe 1984:216).

In 1939, less than 40% of the land in Sussex County was farmed. The acreage of land in farms had declined by nearly one-quarter since 1880, and the number of farms in the county had decreased by 15.3% between 1910 and 1940. Both of these trends were largely the result of changing economic conditions and the difficulties in farming marginal lands (Bausman 1941:4,7). At that time, one of the major problems confronting Sussex farmers was drainage, which today has been largely solved through the construction of a vast network of drainage ditches and channelized streams. The growth of corn and soybeans as cash crops in the county has allowed the reclaimation of over 35,000 acres of land from swamp and brush to tillable acreage in the last forty years (Hancock 1976:100).

Grain farming in the late 1930s was spread fairly evenly across the county, with slightly heavy concentrations of farms in Northwest Fork Hundred and in the southeastern portion of the county. Cannery crops, such as lima beans, tomatoes, and string beans were grown mostly in Broadkill, Cedar creek, and Lewes and Rehoboth hundreds, while truck crops and fruit crops were mostly produced in the fertile western hundreds. Timber lands, brushlands and open untillable lands were the dominate landform in 1941, and covered large portions of the central part of Sussex (Bausman 1941:16-21). Significantly, the farmers of Sussex were characterized in 1941 as being more closely tied to the land than the farmers of New Castle or Kent Counties. There were few foreign born inhabitants in Sussex, and the vast majority were native Delawareans; "in fact, most of the farmers of Sussex County were born and reared in Sussex County" (Bausman 1941:61).

Internal transportation and inter-regional routes continued to develop and connect Sussex more fully with the Mid-Atlanitc region. By 1910 Maryland, Delaware, and Virginia Railroad extended from Lewes to Love Point, a ferry landing on the Chesapeake Bay, providing easier access for the people of the western shore of Maryland to the Delaware beaches. Prior to 1917, Sussex had less than 35 miles of macadam roads in the county, but in that year the first twenty miles of Coleman Du Pont's revolutionary concrete highway was completed, connecting Selbyville with Georgetown. By 1924, the Du Pont highway (present-day Route 113) ran the length of the state (Rae 1975; LeeDecker et al. 1989). By the early 1960s, several state-

maintained highways (Route 13, Route 1) made travel both into and out of the County easier. The improvements in regional transportation in turn stimulated continued tourism growth along the beaches, as witnessed by the establishment of Dewey Beach in 1898, and Bethany a few miles south in 1901 (Hancock 1976:90). Presently, tourism is a powerful economic force in the county, dominating the eastern portions of Sussex for much of any given year. Industry in Sussex is represented by the presence of a major Du Pont nylon plant in Seaford (built in 1939), and other facilities like Nanticoke Homes of Greenwood, and Vlasic Foods at Millsboro (Munroe 1984:189; Hancock 1976:103). Overall, there are over 100 firms in Sussex, employing over 12,000 people, and seven of these, including five food processing plants, one chemical company, and an instrument manufacturer, employ over 250 persons (Hancock 1976:103).

The population of Sussex at the start of this period was over 36,000, making it larger than Kent County, but smaller than the City of Wilmington and New Castle County (Table 4). Throughout this period, the population of the county has grown steadily, spurred by the growth of the broiler industry, the reclaimation of land, and the arrival of light industry to the area. As of 1980, over 98,000 people make their homes in the County (Munroe 1984:269), and this total swells tremendously during the summer season. Inspite of this growth, Sussex is still overwhelmingly rural and agricultural, though intensive suburban and resort development in the last decade are dramatically altering the landscape of the eastern part of the County.

- TABLE 4 -

DELAWARE POPULATION OF NEW CASTLE, KENT AND SUSSEX COUNTIES 1790-1980

Population

Census Year	Total	New Castle	Kent	Sussex	Wilmington
1790	59,096	19,688	18,920	20,488	• • • • • •
1800	64,273	25,361	19,554	19,358	
1810	72,674	24,429	20,495	27,750	• • • • • •
1820	72,749	27,899	20,793	24,057	•••••
1830	76,748	29,720	19,913	27,115	• • • • • • •
1840	78,085	33,120	19,872	25,093	8,367
1850	91,532	42,780	22,816	25,936	13,979
1860	112,216	54,797	27,804	29,615	21,258
1870	125,015	63,515	29,804	31,696	30,841
1880	146,608	77,716	32,874	36,018	42,478
1890	168,493	97,182	32,664	38,647	61,431
1900	184,735	109,697	32,762	42,276	76,508
1910	202,322	123,188	32,721	46,413	87,411
1920	223,003	148,239	31,023	43,741	110,168
1930	238,380	161,032	31,841	45,507	106,597
1940	266,505	179,562	34,441	52,502	112,504
1950	318,085	218,879	37,870	61,336	110,356
1960	446,292	307,446	65,651	73,195	95, 827
1970	548,104	385,856	81,892	80,356	80,386
1980	594,338	398,115	98,219	98,004	70,195

Source: United States Census figures

EXISTING DATA BASE

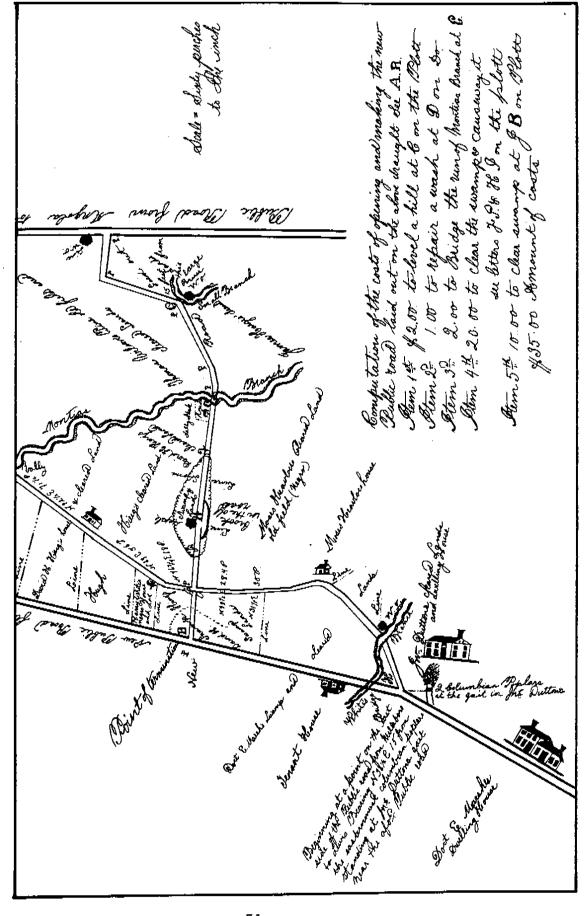
The purpose of this section is to present the existing data base for the prehistoric and historic archaeological sites, and the historic standing structures, that was utilized for the compilation of this report. The cultural context of these sites will also be evaluated based on the general prehistory and history of the project corridor provided above.

Sources used for this study of the cultural resources of the project corridor included the examination of the site files maintained by the Delaware Bureau of Archives and Historic Preservation (BAHP), which contains information on archaeological sites, but primarily data on standing structures.

For historic sites, D.G. Beers' Atlas of the State of Delaware (1868) provided the earliest published map source for specific building locations. Later map sources used included the Sussex County Farm Directory (1913), which was of limited value for site location, and the more useful map produced by R.O. Bausman for his An Economic Study of Land Utilization in Sussex County, Delaware (1941). These three sources, all dating from the mid-nineteenth century and later, were supplimented with an examination of unpublished Sussex County road papers and returns dating from the 1790 to 1863, housed at the Delaware State Archives (Record Group 4200). Over 60 road returns were collected that were located within the project corridor (Figure These road papers, which often contain extremely detailed maps that include dwellings and other structures, provided significant, earlier locational data for historic sites in the project corridor that was unavailable from other sources.

FIGURE 14

Millsboro Road to the Angola Neck Road, Lewes and Rehoboth Hundreds, 1851) Example of Sussex County Road Papers (Detail of the Road from the Lewes-



unusual sites, such as family cemeteries, oral traditions from local inhabitants were particularly helpful in locating these significant resources. All sites that were located within the project corridor were recorded and plotted in United States Geological Survey (USGS) 7.5' quadrangle maps. Relevant information relating to these sites was also recorded from the BAHP site forms.

PREHISTORIC ARCHAEOLOGICAL SITES

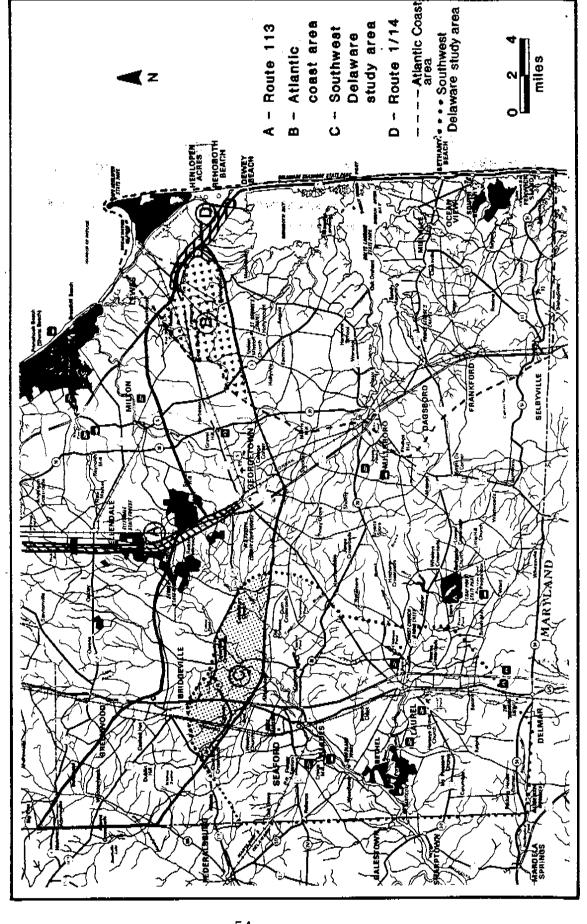
Appendix I lists the known prehistoric archaeological sites located within the project corridor, arranged by USGS map, and Attachment I to this report contains the locations of these sites. Information recorded from the BAHP files and listed in Appendix I includes:

- Map Reference Number. This number is a sequential number arbitrarily given to the site as a map key; it is not an official site number.
- 2) County.
- Delaware Cultural Resources Survey (CRS) Number.
- 4) Description and State Site Number.
- 5) Quad: The USGS 7.5' quadrangle map where the site is located.
- 6) Date: Time period of site occupation. The general time period during which the site was occupied. Time periods are based on those presented in the regional prehistory (see above).
- 7) Functional Site Type. The site types are based on descriptive types applied to the Delaware Coastal Plain by Custer (1983a, 1983b). The basic types include procurement/processing sites (limited function sites occupied for only a short period of time for specialized resource procurement and processing activities), micro-band base camps (habitation sites for small social units), and macro-band base camps (habitiation sites utilized by large social units for extended periods of time).

- 8) Potential: This category deals with the potential archaeological significance of the site. (Yes, No, Unknown)
- 9) Significance: Evaluation of the significance of the archaeological remains. (High, Medium, Low, Unknown)
- 10) References. Any published and unpublished sources for site information on functional site types, time periods of occupation, and cultural complexes are noted. In some cases, artifact collections at the Island Field Museum were examined to check site information on time period of occupation and cultural complexes. These sites are noted.

Several large scale cultural resources investigations have been conducted within the bounds of the project corridor, and these were consulted for any relevant data. Figure 15 shows the locations of these surveys and their relation to the project These previous investigations include the Southwest corridor. Delaware Nanticoke River drainage Survey (Custer and Mellin 1989), the Atlantic Coast Survey (Mellin 1989), the Phase I cultural resources management survey of U.S. 113 between Milford and Georgetown (Leedecker et al. 1989), and the Phase I survey of Delaware Routes 1 and 14 between Five Points and Rehoboth Beach (Tidlow et al. 1988). Reconnaissance Level architectural surveys have been sponsored by the BAHP in Northwest Fork, Nanticoke, Georgetown, Lewes and Rehoboth, Broad Kiln and Indian River hundreds, and in the towns of Bridgeville and Georgetown. Architectural evaluation has presently been completed for Indian River Hundred (Stephen Del Sordo, personal communication, 1990). Several smaller archaeological investigations have been conducted within the project corridor by the Sussex Society of Archaeology and History (see for example Purnell 1962). Additionally, archaeological investigations have been conducted over the last

Previous Archaeological Investigations in the Route 404 Corridor FIGURE 15



several decades on both prehistoric and historic sites in the town of Lewes that have added to the data base of information available for the region (Bonine 1952, 1954, 1956, 1964; Marine 1955, 1958; Marine and Bonine 1965; Peet 1951; Watkins 1951; Thomas 1983).

HISTORIC STANDING STRUCTURES

Appendix II lists the historic standing structures located within the project corridor that are contained in the BAHP site files. The Appendix contains data relevant to the historical-architectural interpretation of the standing structures, and addresses the potential and significance of any associated archaeological remains. Data recorded for each standing structure and included in Appendix II includes:

- 1) County.
- Delaware Cultural Resource Survey (CRS) Number.
- Description and/or material. (The construction material of the structure.
- 4) Quad: The USGS 7.5' quadrangle map where the structure is located.
- Date: The date of initial construction of the present structure. Dates were obtained from the BAHP site files and from examinations of Beers' Atlas (1868), the Sussex County Farm Directory (1913), and Bausman's map of Sussex (1941). Dates are relative, i.e., "p1868" (prior to 1868); "al941" (after 1941).
- 6) Function: The primary historic function of the structure. Functions were determined from the BAHP site files, and from map sources noted above. Categories of function are similar to those used by Custer et al. (1984:22-23), but have been modified somewhat, primarily by the combining of some categories and the elimination of others. The function categories are listed below, with the abbreviations they receive in Appendix II.

- 6) Function: (cont.)
- A. Residential/Agricultural
 - Dwelling Complex (DWCX)
 - 2. Dwelling (DWLG)
 - 3. Agricultural Complex (AGCX)
 - 4. Family Cemetery (FAM CEM)
 - 5. Agricultural Tenant (AGTEN)
 - 6. Agricultural Building (AGBLDG)
 - Agricultural Manufactory Complex (AGMCX)
- B. Industrial
 - Forge/Furnace (FORG)
 - 2. Grist Mill (GMILL)
 - 3. Saw Mill (SMIL)
 - 4. Mill Dam (MDAM)
 - 5. Brickyard (BRICK)
 - 6. Steam Saw Mill (SSMILL)
 - 7. Mill (MILL)
 - Water Tower (WTOWR)
- C. Commercial
 - 1. Store (STO)
 - 2. Office (OFFI)
 - Service Station (SERVST)
 - 4. Resturant (EATERY)
- D. Religious
 - 1. Church (CHUR)
 - Church Cemetery (CCEM)
- E. Governmental
 - 1. School (SCH)
 - Almshouse (ALMHSE)
 - Community Center (COMCEN)
- F. Transportation
 - Bridge (BRID)
- 7) Potential: This category deals with the potential archaeological significance of the structure. (Yes, No, Unknown)
- 8) Significance: The historical significance of the structure in relation to other historic standing structures in the area. (High, Medium, Low, Unknown)
- References: Same as for Appendix I.
- 10) NR: Whether the structure is listed on the National Register of Historic Places.

POTENTIAL HISTORIC ARCHAEOLOGICAL SITES

Appendix III contains a list of known or potential historic archaeological sites located within the project corridor. list was compiled from the BAHP site files of standing structures, from published historic maps, and from the manuscript Sussex County Road Papers. The list differs slightly from the standing structure appendix described above (Appendix II) in that few of these sites are presently listed in the BAHP files and therefore do not possess CRS numbers. It should be noted that none of these sites were field checked. This list suppliments the BAHP site files because it identifies the locations of structures which are no longer extant but for which there is a potential for archaeological remains, and it updates and corrects omissions in the BAHP standing structure files. Appendix III summarizes the data concerning these historical archaeological sites and assesses the potential and significance of these sites. The information contained in the appendix is as follows:

- Map Reference Number. An arbitrary designation to be used as a map key and strictly for use with this cultural resources assessment.
- 2) Quad: The USGS 7.5' quadrangle map the site is located on.
- 3) Hun: The Hundred which the site is located in.
- 4) Date Range: The earliest date range for which the site is known. Date ranges are based on the periodization as per Ames et al. (1989). Like the dates for standing structures, these dates are not absolute, but fall within a range of time.
- 5) Site Type/Function: The primary functional use of the site based on interpretation of documentary sources and site setting. Site functions are identical to those used for standing structures (see Appendix II above).

- 6) CRS: The site's cultural resource number, if it has been assigned one.
- 7) Historic Name: The site name, from historic sources.
- 8) NR: Whether the site is presently listed on the National Register of Historic Places.
- 9) References: The historic source which provided the earliest evidence of a site location.
- 10) Potential: Evaluation of the potential of the archaeological remains. ((Yes, No, Unknown)
- 11) Significance: Evaluation of the significance of the archaeological remains. (High, Medium, Low, Unknown)

UNINVENTORIED STANDING STRUCTURES

Appendix IV contains a list of standing structures which present a special case of cultural resources in the project area. This appendix lists those structures which are presently located on sites of historically documented structures -- i.e., these buildings were shown on Beers' Atlas (1868) -- but have not been inventoried by the BAHP. Structures included in this appendix are therefore of potential historical and/or archaeological significance, whether both or neither is presently unknown. Little information is available at present concerning these structures, and Appendix IV is included simply to provide a compilation of these potential sites. Information included in the appendix is as follows:

- County.
- CRS: The site's Cultural Resource Number.
- 3) Description, name or function of site.
- 4) Quad: The USGS 7.5' quadrangle map the structure is located on.

CULTURAL CONTEXT AND DATA QUALITY

The purpose of this section is to assess the quality of the data noted in Appendices I - III and to provide a brief discussion of the cultural context of the sites noted in the inventories. Specifically, the discussion of the cultural context will seek to relate the specific sites in the inventories to the general trends noted in the earlier discussion of the region's prehistory and history.

PREHISTORIC SITES

Table 5 provides a summary of the known prehistoric sites found within the project area while Figure 16 shows the locations. In general, a variety of sites of different time periods are noted. However, before considering the cultural context of these sites, it is necessary to consider the quality of the data base of known prehistoric sites.

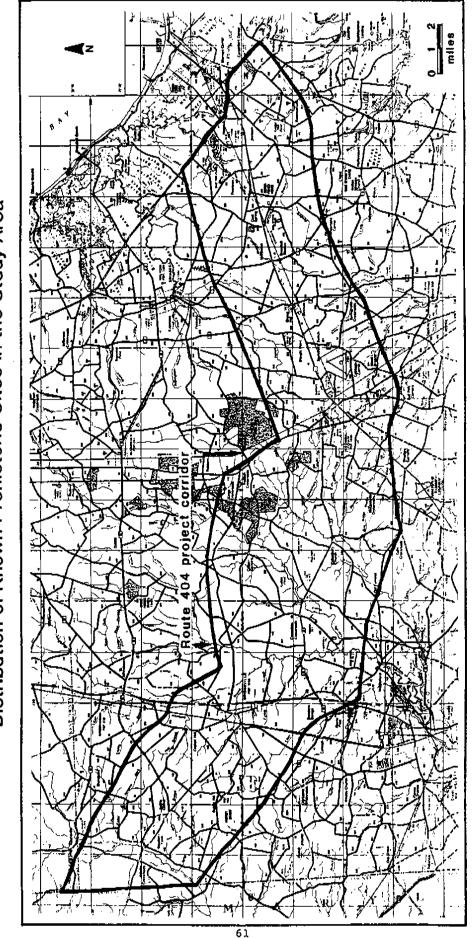
The state site files, from which the inventory in Appendix I was generated, record only the sites located in places where people have looked for archaeological sites. Although two large research-oriented projects generated some of the data found in the site files (Figure 15), for the most part these files provide a very biased sample of the possible site locations within the project area. The presence or absence of certain types of sites from varied time periods, and the relative abundance of sites of any function of age, cannot be used for anything other than an initial approximation of the total range of prehistoric cultural resources that may be found in the area. Nevertheless, the data from these site files can be used to develop initial impressions,

			rable !	5 ——			
SUMMAI	RY OF KNOWN	PREH	ISTORIC	ARCHAI	COLOGICA	L SITES	
Quad	Number	P	A	WI	WII	BC	P/P
Ellendale	4	0	0	0	0	0	0
Fairmont	15	0	0	4	3	5	5
Georgetown	13	1	1	8	4	5	3
Greenwood	2	1	O	0	0	0	0
Harbeson	6	0	0	1	2	. 0	0
Hickman	9	0	0	3	2	1	0 ;
Lewes	4	0	O	0	0	: 0	0
Seaford East	27	1	1	18	9	6	21
Seaford West	4	0	0	2	0	0	4
Total	84	3	2	36	20	17	33
<pre>Key: P - Paleo-ind A - Archaic WI - Woodland</pre>		BC	- Base	dland I ecamp curemen	I t Proces	sing	

and testable hypotheses about prehistoric site locations (for example, see Custer, Cavallo, and Stewart 1983; Custer and Wallace 1982). It should also be noted that in the central portion of the study area along the Nanticoke there is a relatively controlled sample of site data available (Custer 1989). With these limitations of the data in mind, the cultural context of the known sites can be evaluated and patterns of site locations can be tentatively noted.

Three sites dating to the Paleo-Indian Period are noted in the site files for the study area. This finding is an indication that population densities in the study area were probably low.

Distribution of Known Prehistoric Sites in the Study Area FIGURE 16



* Site locations on file at Delaware Dept. of Transportation and University of Delaware.

Paleo-Indian settlement pattern models from the Middle Atlantic Coastal Plain (Custer, Cavallo, and Stewart 1983) and summaries of fluted point data from the Delmarva Peninsula (Custer 1983a: Chapter 3;, 1984b) note that there are two concentrations of fluted point finds in Delaware. One is in the northern part of the state between Newark, Delaware, and Elkton, Maryland, and is associated with outcrops of high quality cryptocrystalline lithic materials (Custer and Galasso 1980; Custer, Ward, and Watson Another site concentration is located along the poorly drained mid-peninsular drainage divide where there are good data indicating the presence of numerous game-attractive swamps and bogs during later Pleistocene and Early Holocene times. study area crosses a large portion of this Mid-Peninsular Drainage Divide and many interior swamps and bogs are present. Two of the three known Paleo-Indian sites are associated with areas that were once poorly-drained woodlands and more such sites are probably present in the study area.

Only two known Archaic sites are present in the study. Both of these components co-occur with Paleo-Indian components on sand ridges adjacent to areas that were once poorly-drained woodlands. As was the case for Paleo-Indian sites, there are probably many more Archaic sites in the study area.

Sites of the Woodland I Period represent the greatest portion of the recorded prehistoric sites in the proposed highway corridor. Of the 84 known sites, 36 had identifiable Woodland I components. Woodland I base camps are located primarily along the floodplains of the major drainages and have the highest proportion of multi-component sites. Some Woodland I base camps

are also found in the same interior sand ridge settings as the Paleo-Indian and Archaic sites. Generally, all of the various Woodland I culture complexes are represented among the recorded Woodland I base camp sites. However, Barker's Landing Complex and Carey Complex components are among the most common among the sites recorded in the study area. In sum, the entire range of Woodland I functional site types, except for specialized mortuary sites, and the entire range of Woodland I culture complexes are present in the study area.

Twenty Woodland II sites are recorded for the study area. Most of the Woodland II base camps are multi-component and have evidence of earlier Woodland I occupations. This continuity of base camp locations has been viewed as indicative of continuities in adaptations between the Woodland I and II Periods in southern Delaware (Custer and Griffith 1986). Little or no information is available on Woodland II procurement sites. No Contact Period sites were noted for the study area in the state site files.

HISTORIC SITES

The historic standing structures identified in the project corridor are listed in Appendix II and summarized in Table 6. As can be seen, the overwhelming majority -- over 93% -- of inventoried standing structures within the project corridor date from the last two historic periods (1830 to 1880, and 1880 to 1940+). In fact, over 66% of the total number of inventoried standing structures were built in the 1880 to 1940+ period. The other three chronological periods are poorly represented, with only .3% for the 1630 to 1730 period, .6% from the 1730 to 1770

TABLE 6 -

SUMMARY OF STANDING STRUCTURES FROM THE BAHP SITE FILES WITHIN THE PROJECT CORRIDOR

•			Date Range			
Quads	1630-1730	1730-1770	1770-1830	1830-1880	1880-1940+	Unk
Ellendale	-	-	***	5	7	- .
Fairmount	1	-	_	45	52	8
Georgetown	-		8	33	63	_
Greenwood	1		-	13	41	
Harbeson	_	-	9	37	51	-
Hickman	_	1	2	18	95	1
Lewes	_		3	8	14	-
Milton	_	1	-	4	12	1
Sea. East	-	2	3	30	118	4
Sea. West	_	_	-	2	18	-
Total	2	4	25	195	471	14

KEY:

Unk = Unknown Sea. = Seaford

period, and 3.5% from the 1770 to 1830 period. The project corridor seems to accurately reflect the housing situation in Sussex County overall, for Ames et al. (1987:58) have estimated that about 77% of the housing stock in in the county has been constructed since 1940.

Site functional types are fairly well-represented throughout the corridor, considering that Sussex County has been and remains a predominately agricultural region (Table 7). The vast majority of sites are either agricultural complexes, dwelling complexes or dwellings (260, 269, and 127, respectively). Churches account for 11 sites. Most of the churches date from the 1830 to 1880 period, such as Reeds Methodist Church (S-3172) and Trinity Methodist Church (S-329), though some, like the Coolspring Presbyterian Church (S-138) and the Cokesberry Church (S-409)

-TABLE 7 — SUMMARY OF SITE TYPES/QUAD WITHIN THE PROJECT CORRIDOR Ouad Site Type Mtn Hick Lew Fmt Harb Gtwn Gnwd Sea E Sea W Ell Total AgCx 46 11 9 40 39 40 16 47 4 8 260 40 21 DwCx 41 5 5 43 32 69 11 2 269 25 7 3. 20 Dwlg 6 19 16 25 5 1 127 Church 2 1 2 5 1 11 Cemetery 5 8 17 Store 2 2 1 5 2 2 Bridge 5 1 Water Tower 1 1 Serv. Stn. 1 1 2 School 1 3 2 Ag. Bldg. 2 Saw Mill 2 2 Eatery 1 1 Grist Mill 1 1 Office 1 Almshouse 1 1 Ag. M. Cx. l 1 Mill1 1 Com. Center 1 1 Total 117 25 18 105 97 104 55 159 20 11 711 KEY: Hick = Hickman AgCx = Agricultural Complex Lew = Lewes DwCx ≃ Dwelling Complex = Milton Dwlg Mtn = Dwelling Fmt = Fairmount Serv. Stn. = Service Station Harb = Harbeson Ag. Bldg. = Agricultural Building = Georgetown Ag. M. Cx. Gtwn = Agricultural Manufacturing = Greenwood Gnwd Complex Sea E = Seaford East Com. Center = Community Center Sea W = Seaford West

date from earlier periods. Cemeteries account for 17 sites in the BAHP files, and many of these are not church-related, but are associated with farms throughout the project corridor. These family graveyards are an indication of the generational continuity of the inhabitants of Sussex, a phenomena noted by Bausman in 1941, and discussed previously.

Ell

= Ellendale

The remainder of the sites compiled from the BAHP files include five retail structures, such as Scott's Store (S-823), a National register site dating to the mid-1870s, an early twentieth century eatery (S-6066), an office (S-3224), and two service stations (S-3296, S-5044). Transportation-oriented sites are represented by five bridges built in the project corridor in the early 1930s. The agricultural-orientation of the project corridor throughout its history is demonstrated by agricultural buildings, agricultural manufacturing complexes, a wooden watertower (S-356), and several saw and grist mills. The rest of the site types are rounded out by community and government structures, such as the Cool Springs Community Center (S-3025), three former one-room schools, and the county almshouse (S-210), built in the early nineteenth century.

There are a total of 434 potential historic archaeological sites located within the project corridor. Appendix III contains a complete inventory of these sites, and Table 8 presents a summary of these sites by chronological period. Several standing structures have been included within this Appendix because these are structures that are known from the BAHP files to be standing on the locations of earlier buildings. It can be seen that by far the greatest number of sites (370) date from the 1830 to 1880 period of historic settlement; this is undoubtably a bias in the historic source materials utilized for this study, since the only historic atlas showing the project area dates from this time period, and there are few earlier published and detailed maps which can be used. Most of the identified sites were plotted from Beers' Atlas (1868), while the remaining sites were located

SUMMARY OF POTENTIAL HISTORIC ARCHAEOLOGICAL SITES BY CHRONOLOGICAL PERIOD									
	SITE Nan	TYPE Geo	S PER Indr	HUNDR L+R	ED: 1	.630-1 Brk		Go.43	metel
Church	ман	GE 0	Indi	1	NWE	PLK	Mis -	Ced	Total 1
Dwelling	-		-	ī	-	_	_	_	1
Total	—			2					2
SITE TYPES PER HUNDRED: 1730-1770									
	Nan	Geo	Indr	L+R	NWF	Brk	Mis	Ced	Total
Dwelling	-	_	-	1	1	1	_	_	3
Forge	2	_	_	-	-	_	· -	_	2
Ag. Tenant	-	-	-	1	_	-	_	-	1
	2					1		. —	6
	SITE	TYPE:		HUNDR	ED: 1	770-1	830		
	Nan	Geo	Indr	L+R	NWP	Brk	Mis	Ced	Total
Ag. Complex	-	_	2	1	4	1	_	-	8
Almshouse	_	1	-		_	-	-	-	1
Bridge	1	_	-	_	_	-	_	-	1
Dwelling	-	_	-	1	4	1	_	-	6
Family Cemetery	-	_	_	-	_	2	-	-	2
Forge	2	_	-	-	_	_	_	-	2
Grist Mill	1	-	_	-	_	_	-	_	1
Mill Dam	1	_	-		-	-	_	_	ı
Mill	-	-	-	1	_	-	_	-	1
Saw Mill	-	_	-	-	2	-	_	_	2
	5	 1		3	10	4			25
•	SITE	TYPE	S PER	HUNDR	ED: 1	830-1	880		
	Nan	Geo	Indr	L+R	NWP	Brk	Mis	Ced	Total
Ag. Complex	82	56	20	35	69	24	3	_	288
Ag. Tenant	1	5	1	-	2	_	_	_	9
Almshouse		1	_	_	_	_	_	_	ī
Blacksmith Shop	-	_	· -	_	1	-	_	_	ı
Church Cemetery	2	1	_	_	_	_	_	_	1 3 3
Church	-	_	_	1	2	-	_	_	3
Dwelling Complex	2	2	4	4	2	_	_	_	14
Dwelling	1	2	_	2	1	5	_	l	12
Family Cemetery	6	1	_	_	_	3	_	_	10
Grist Mill	2	_	_	_	_	1	_	_	3
Mill Dam	-	1	_	_	_	_	_	-	ì
Office	_	_	_	1	_	_		-	ī
School	6	_	1	1	2	_		_	10
Saw Mill	1	_	_	_	2	2	_	_	5
Store	2	-	-	_	2	1	_	_	5

	-		TABLE	8 (co	nt.)-				<u> </u>
	SITE Nan			HUNDR L+R				Ced	Total
Church Cemetery Dwelling Complex Dwelling	1	1 - 2		1	- - -	- -	- - -	- 1 - 1	1 1 5 —————————————————————————————————
Nan = Nanticoke Brk = Broadkill Geo = Georgetown Mis = Mispillion Indr = Indian River Ced = Cedar's Neck L+R = Lewes and Rehoboth Ag. = Agricultural NWF = Northwest Fork									

from examinations of primary source documentation, in particular the manuscript Sussex County Road Papers dating prior to 1863. There are also few sites from the 1880 to 1940 time period, and this is due to the fact that most of these sites are presently occupied by standing structures, and are included in Appendix II. Site types represented by the potential historic archaeological sites are representative of the region as of the mid-nineteenth century, and consist mainly of agricultural complexes. Some grist and saw mills are present, and four unique sites, the Collins Forge, Old Furnace, Gravelly Delight Forge, and Unity Forge, are all archaeological cultural resources within the project corridor.

Taken together, the biases inherent in the historic archaeological sites information are partially corrected, because the standing structure files indicate that a substantial number of sites dating from the 1830 to 1880 period are still extant, and both data sources indicate that the earlier periods are under-represented. Based on the standing structures listed in

Appendix II and the potential historic archaeological sites listed in Appendix III, a grand total of 1,147 historic sites are located within the project corridor; this number should be somewhat lower, due to the cross-listing of several sites in both Appendices. By combining these data bases, it can be seen that the first three periods are under-represented within the project corridor: there are only four sites from the 1630 to 1730 period, ten from the 1730 to 1770 period, and 50 from the 1770 to 1830 period. By contrast, there are at least 565 historic sites dating from the 1830 to 1880 period, and 485 dating to the 1880 to 1940+ period. These results suggest that the last two periods can be studied best from existing standing structures supplimented by archaeological investigations, while the first three periods can best be examined by archaeological inquiry, due to the paucity of sites, standing structures, and functional types dating from prior to the mid-nineteenth century in the project corridor.

PREDICTIVE MODELS

The previous section of this report presented the inventories of known, and previously recorded, prehistoric and historic archaeological sites. As was noted earlier, the sites recorded in the state records do not represent all the cultural resources in the study area, or even an unbiased sample. Consequently, it is necessary to use projections of potential archaeological site locations (predictive models) to make management and planning decisions about cultural resources. This section describes the uses of predictive models in prehistoric

and historic archaeology and applies various types of predictive models to the study area.

PREHISTORIC SITES

Predictive models must be applied to the study of prehistoric archaeological resources for a number of reasons. First, a complete inventory of all prehistoric archaeological sites is not possible due to cost limitations. Also, archaeological site discovery often entails at least partial site destruction. Thus, it is necessary to develop predictions of where various types of prehistoric archaeological sites of various ages are likely to be found.

Development of these predictions for prehistoric sites can be accomplished in a number of different ways (Kohler 1988). One method utilizes detailed analyses of modern resource distributions and studies of living hunter-gatherer populations to predict what sorts of places similar populations might have inhabited in the past (eg., Jochim 1976). Because of the detailed nature of the required resource distribution analyses and the limitations of the currently available paleoenvironmental data base, modern environments must be used to develop the models. While these models have been applied to, and work well for, late prehistoric groups (eg., Thomas et al. 1975), the projections of these models and their predictions into the more distant past, is risky, at best, as noted by Binford (1978). Also, the predictions generated from the application of these models in the Middle Atlantic Coastal Plain (Cameron 1976) have been contradicted by empirical data from archaeological sites (Custer, Stiner and Watson 1983; McNamara 1982). Another method of generating predictive models uses samples of modern site distributions to develop quantitative assessments of densities of site per unit areas of various size and configuration (Wilke and Thompson 1977; Luckenbach and Clark 1982). These studies do not distinguish among the various classes of archaeological sites encountered and, therefore, such studies are not appropriate for all kinds of resource management because they ignore the cultural content of archaeological sites as well as the potential to yield useful data which establishes these sites' significance (Raab and Klinger 1977). Also, these studies do not link the site densities, with locational data which allow the plotting of areas of differential site densities.

The alternative to the approaches noted above is the traditional approach to predictive modelling developed and utilized by William M. Gardner and his students at Catholic University. Gardner's (1978, 1982) studies consider the existing data on site locations for various classes of sites from different time periods. Correlations between site locations and environmental settings are then determined. If controlled samples are available, statistical analyses may be used (Custer 1980; Wells et al. 1981; Custer and Galasso 1983; Eveleigh et al. 1983); however, if uncontrolled samples are utilized the analyses are more impressionistic (Gardner 1978, 1982; Custer and Wallace 1982). Whatever the type of analysis, a series of descriptions of typical site locations are developed. These descriptions may be in the form of listings of significant variables (Gardner

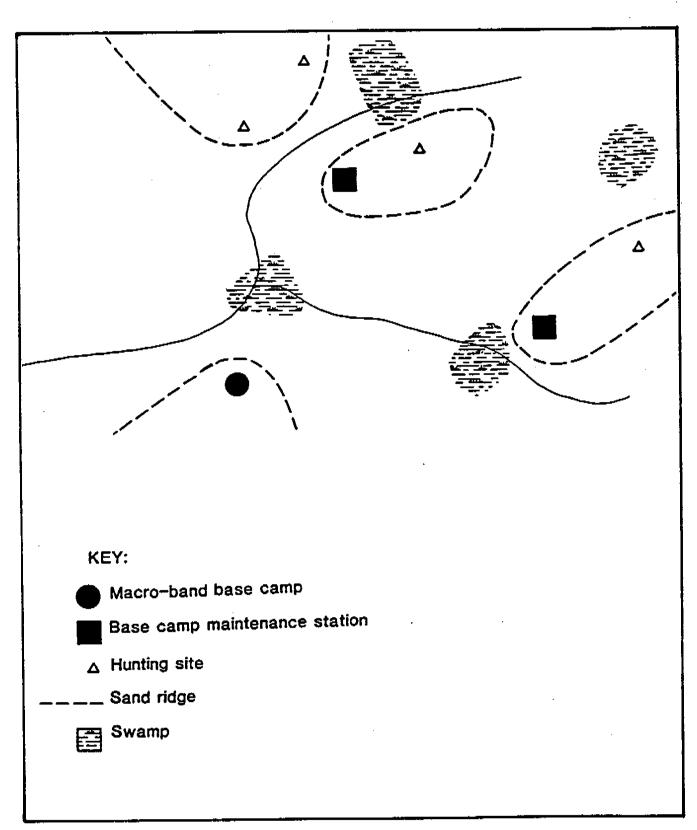
1978; Cunningham 1983), narrative descriptions of typical site locations (Stewart 1981; Wall 1981; Tolley 1983), diagrams of site locations (Hoffman and Foss 1980; Custer and Wallace 1982; Custer 1983a, 1983b, 1983c), descriptions of site locations using quantitative data (Hughes and Weissman 1982), or quantitative projections of numbers and types of sites within varied environmental zones (Custer 1980; Custer and Galasso 1983). No matter what their form, these predictions can then be used for resource management and further research and testing. This approach will be used in this study and is preferable to the other approached for management purposes because it considers the cultural content of sites and specifically predicts their locations.

The approach to predictive model generation noted above can be applied to the study area at a variety of levels. The most general level is to use the initial predictive models developed for the Delaware plan for the management of prehistoric cultural resources (Custer 1983b), a similar plan developed for the Upper Delmarva region of Maryland (Custer 1983c and several smaller regional management plans (Custer and De Santis 1986; Custer 1983b, 1987). In these management plans, a series of diagrams showing relationships among sites and typical site locations were formulated. Also, tabular summary descriptions of typical site locations were prepared. The tabular summaries and diagrams were then combined to define study units for each of the major cultural periods. In order to apply these models to the present study, the proposed highway corridor was plotted in relation to

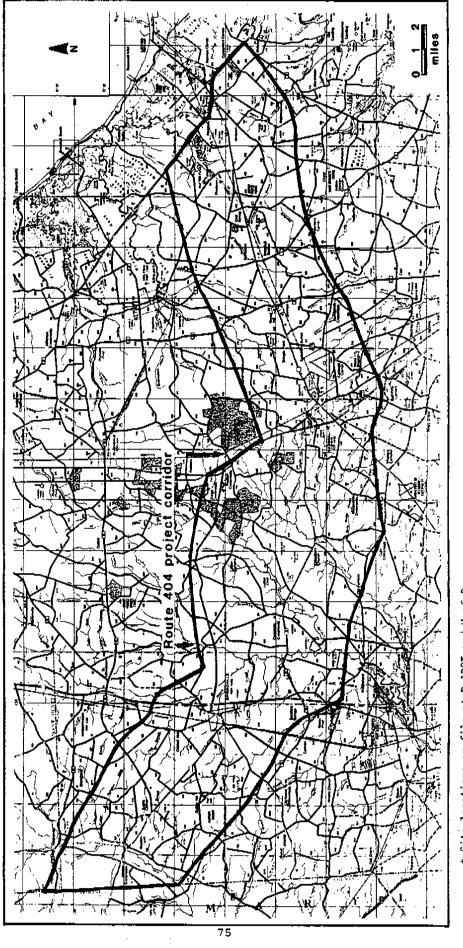
the study areas from the state plan (Custer 1983b), the Atlantic Coast regional plan (Custer 1987), and the southwestern Delaware regional plan (Custer 1989) and the relevant diagrams and descriptions of typical locations noted. The relevant site models and study units are described below for each cultural period. Site distributions within the study area will also be discussed and Figure 15 shows the distribution of known sites in the study area.

For the Paleo-Indian Period, the entire project area falls within a study area that has a low data quality and a low probability for all types of Paleo-Indian sites (Custer 1983b; Custer 1984c). Figure 17 shows the typical environmental locations for Paleo-Indian sites that can be expected to occur in These sites include base camps (habitation the study area. sites) and hunting and maintenance sites where various resources were procured. Generally, this model would be most applicable in the drainage divide area although similar patterns would be seen with a lower frequency throughout the project area (Figure 18). Figure 19 shows a "serial" model of group movements (Custer, Cavallo, and Stewart 1983) that would most likely have linked sets of the site locations noted in Figure 17. The serial model assumes that Paleo-Indian groups would move from base camp to base camp with movements dictated by resource availability. groups moved, various hunting locales and lithic resources would be used on a serial basis. Application of the serial model is based on the fact that lithic resources within the project area are small, scattered, and numerous (Custer and Galasso 1980).

FIGURE 17
Paleo-Indian/Archaic Settlement Pattern

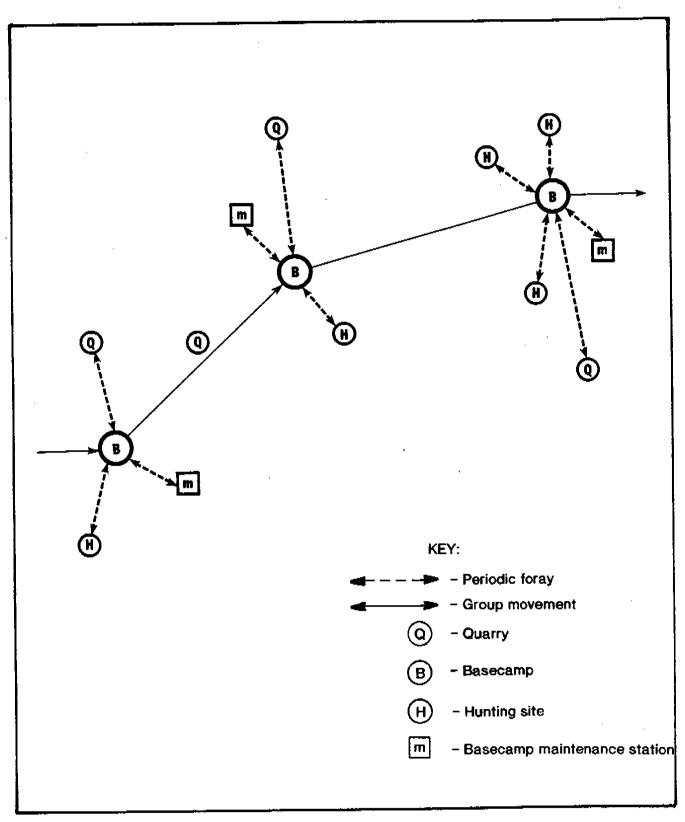


Predictive Models of Paleo-Indian Site Locations in the Project Corridor FIGURE 18



* Site locations on file at DelDOT and U of D.

FIGURE 19
Serial Settlement/Lithic Utilization Model



<u> </u>	TABLE 9
	PALEO-INDIAN SITE LOCATIONS
Site Types	Locations
Base camp	well-drained ridge in areas of maximum habitat overlap
Base camp maintenance station	game attractive locale close to base camp (swamps, bay/basin)
Hunting site	<pre>game attractive locales away from base camp (swamps, bay/basin)</pre>

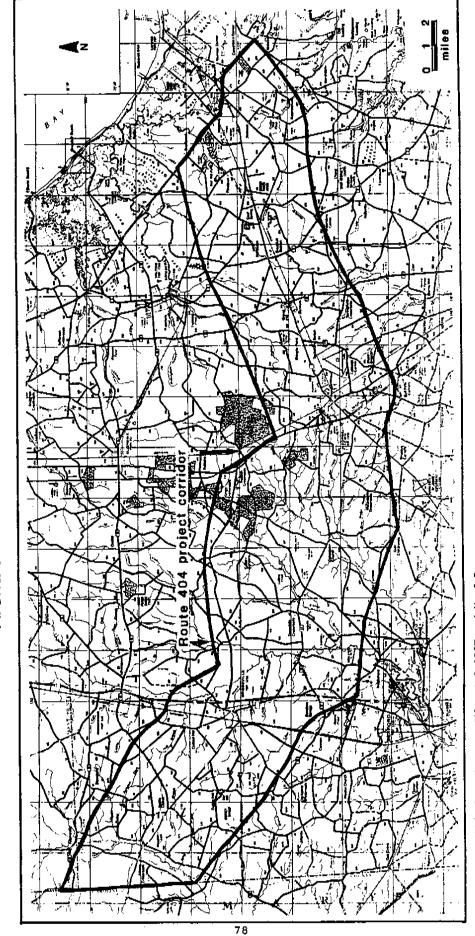
Table 9 provides summary descriptions of typical Paleo-Indian site locations for the project area.

The site location model (Figure 17) and the summary site location descriptions noted in Table 9 would also apply to the Archaic Period in the study area because the limited site data (Figure 20) and other studies (Custer 1986a, 1989) show that there were only limited changes in settlement patterns during the Archaic.

Woodland I sites are the most common sites in the study area (Figure 21), and for the most part, the locational characteristics of these sites are not that different from those of earlier sites. Nevertheless, it can be noted that Woodland I settlement in the study area, especially along the Nanticoke drainage, is significantly more intensive than that of earlier time periods (Figure 22). The presence of ceramics also allows the identification of individual cultural complexes at sites, and maps of sites for each Woodland I cultural complexes on the general Nanticoke drainage are shown in Figures 23-26.

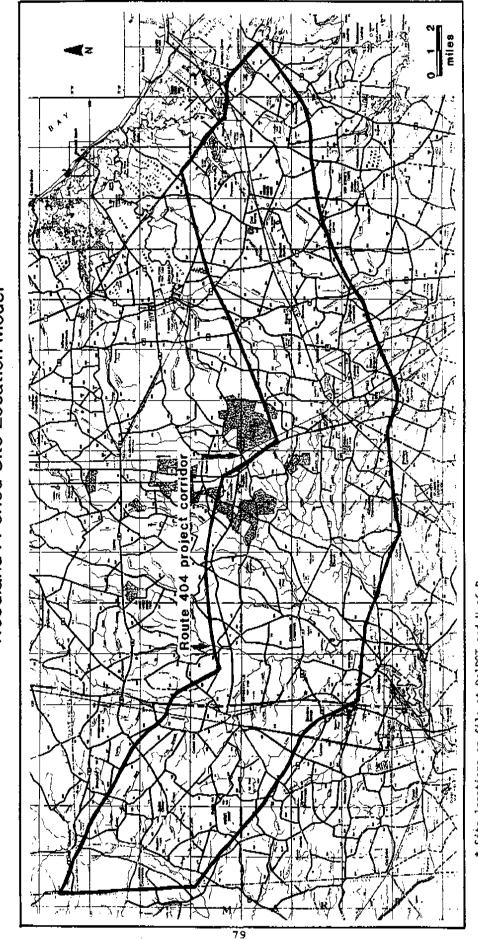
Archaic Period Site Location Model

FIGURE 20



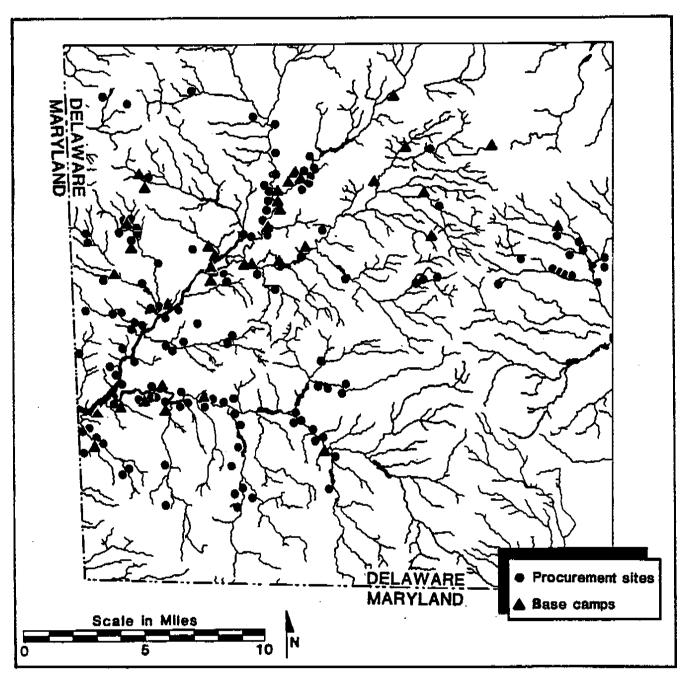
 $\boldsymbol{\star}$ Site locations on file at DelDOT and U of D.

FIGURE 21
Woodland I Period Site Location Model



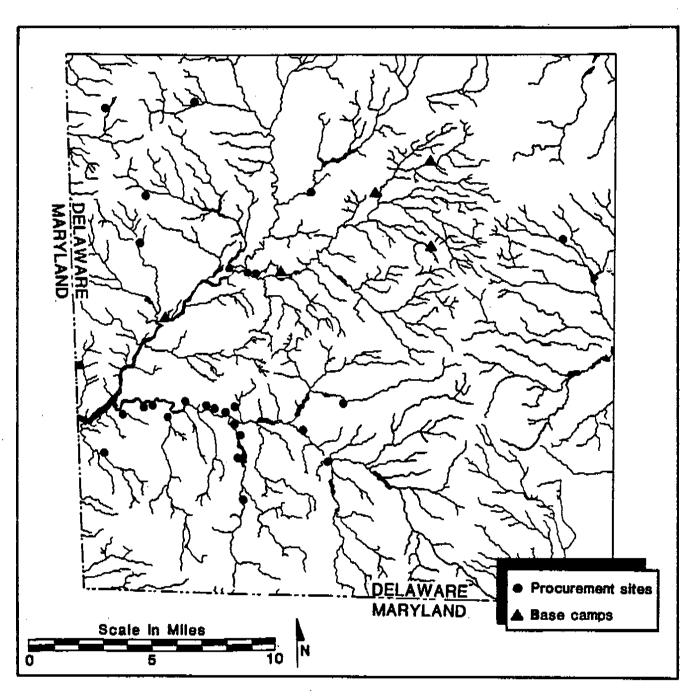
* Site locations on file at DelDOT and U of D.

FIGURE 22
Woodland I Site Locations from
the General Nanticoke Drainage



There are numerous Clyde Farm Complex sites (Figure 23) in the study area. The base camp distribution is the same as that of the general Woodland I time period. However, there does seem to be an especially large number of Clyde Farm Complex procurement sites along

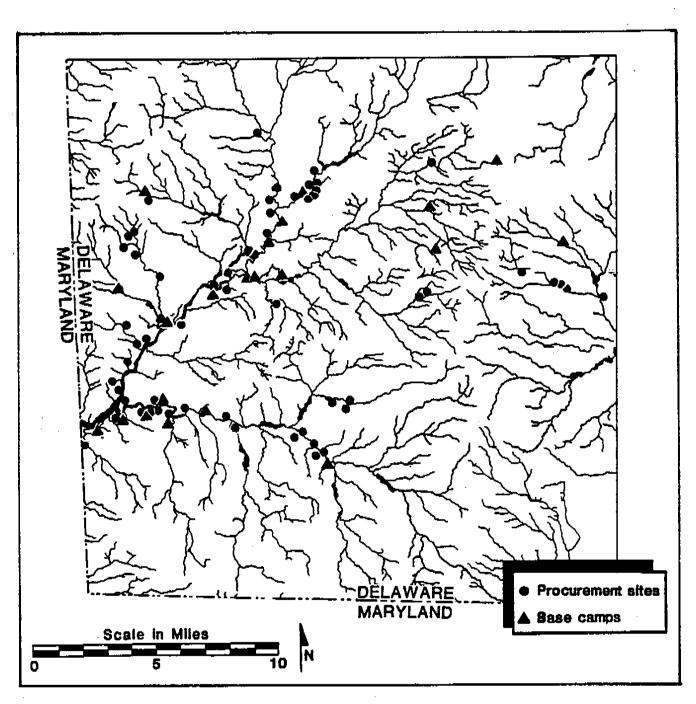
FIGURE 23
Clyde Farm Site Locations



Broad Creek, especially between Records Pond and the Nanticoke River.

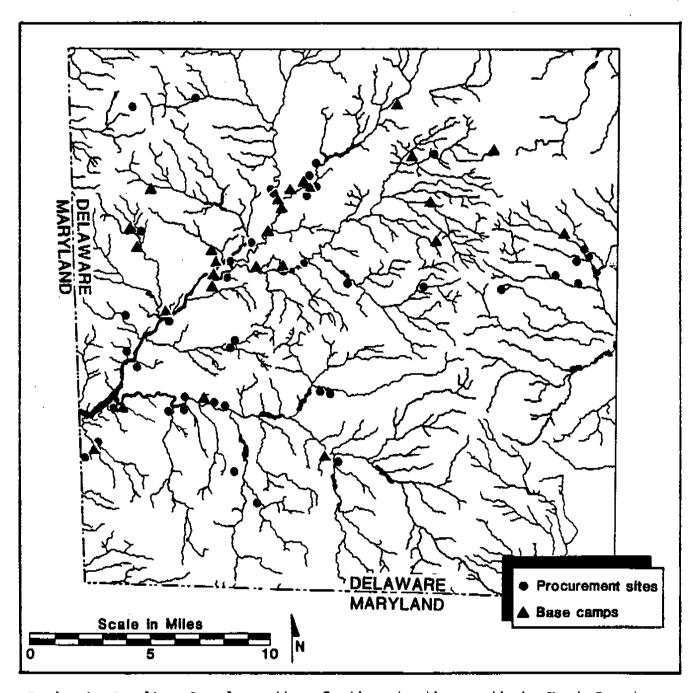
It may be that Clyde Farm settlement systems in this area involved a seasonal shift between base camps in riverine and drainage divide areas. However, this hypothesis needs to be tested with future

FIGURE 24
Wolfe Neck Site Locations



fieldwork. Some non-local lithic materials, including argillite, rhyolite, and steatite are present at these sites (Custer 1984c) indicating the existence of trade and exchange networks. However, the extent of non-local materials is not as great as that seen for

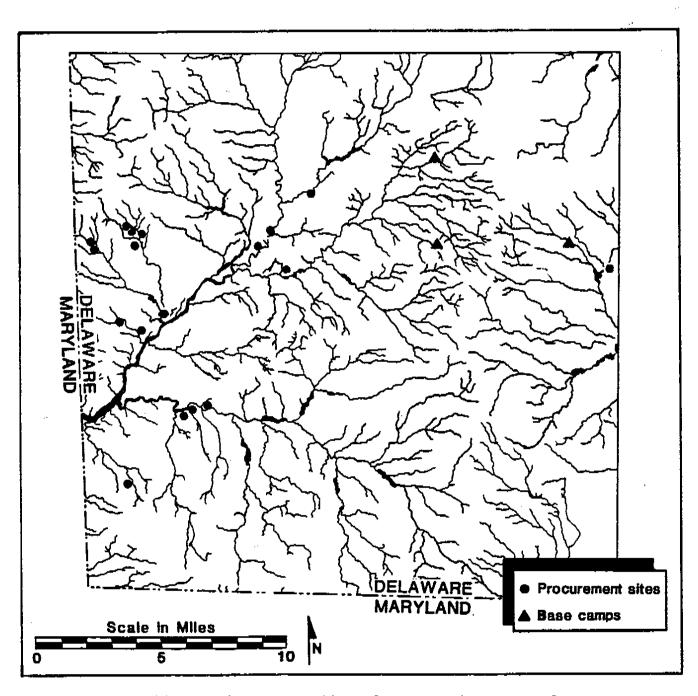
FIGURE 25 Carey Site Locations



Barker's Landing Complex sites further to the north in Kent County.

Between 500 B.C. and 0 A.D., two roughly contemporaneous culture complexes, Wolfe Neck and Delmarva Adena are recognized for southern Delaware. The two complexes are generally thought

FIGURE 26
Late Carey Site Locations



to be mutually exclusive with Delmarva Adena Complex groups differentiated from Wolfe Neck groups by the presence of mortuary ceremonialism, non-local artifacts from Ohio, and more complex social systems (Custer 1984a:113). It is also known that the

Wolfe Neck complex slightly predates the Delmarva Adena complex (Custer 1984a:87; Griffith 1982). Whatever the relationship between the complexes, sites with occupations of both complexes are present to the west of the study area in the Atlantic Coast region (Custer 1987: Figures 23 and 24) where several individual sites have occupations by both complexes. It is also especially interesting to note that the Atlantic Coastal area includes one clear-cut example of a Delmarva Adena living site, the Wilgus Site - 7S-K-21 (Custer, Stiner, and Watson 1983). Given the presence of a living site, it is possible that complex mortuary sites may also be present in the Atlantic Coast area. In fact, one Delmarva Adena mortuary site, the Nassawango Site (Wise 1974), has been identified to the southwest of the study area on the Wicomico drainage in Worcester County, Maryland. Nanticoke study area, there are some occurrences of Delmarva Adena related ceramics (Coulbourn, Nassawango, and Wilgus), but there are few, if any, finds of clear-cut Adena mortuary artifacts. Therefore, all sites with Wolfe Neck or Coulbourn and related crushed clay tempered ceramics in the study area were placed in a single Wolfe Neck Complex (Figure 24). Further research on these sites may help to clarify the relationships between the societies of these two archaeological complexes.

Moving from Clyde Farm to Wolfe Neck Complex times (ca. 500 B.C.), the number of base camps increased dramatically in the riverine area (Figure 24). There is a definite shift from the use of lower Broad Creek as a procurement site area to a base camp area. This kind of shift and the dramatic increase in the

number of base camp sites indicates increasing population densities in the riverine area. Similar settlement pattern trends are seen throughout the Delmarva Peninsula during Clyde Farm and Wolfe Neck times (Custer 1984a:94-130, 1988) and are thought to be related to environmental changes that occurred at this time (Custer 1984a:89-91). In general, these environmental changes exacerbated the well-watered/poorly-watered dichotomy of the environment and made riverine settings even more attractive than they were during earlier time periods.

With the onset of the Carey Complex (ca. A.D. 0), the basic settlement pattern of the Wolfe Neck Complex remained with little or no change in intensity (Figure 25). Presumably, population densities did not increase at this time. However, Carey Complex base camps tended to be located even further up the drainage than Wolfe Neck Complex base camps. Similar settlement shifts are noted for other Coastal Plain drainages (Custer 1984a:144) and are thought to be related to the upstream movement of the brackish/freshwater transition zone due to sea level rise.

By Late Carey Complex times (ca. A.D. 500 - 1000), there is a pronounced decrease in the number of sites in the Nanticoke drainage (Figure 26). It is possible that some of this decrease in settlement intensity is due to problems with identifying some ceramics from this time period. For example, the shell tempered refined-Mockley, or Claggett, ceramics (Custer 1984a:88-89) easily grade into earlier Mockley and late Townsend wares (Griffith 1982). However, there are other easily recognizable diagnostic artifacts from this time period such as Hell Island ceramics and Jacks Reef projectile points. Also, the reduction

in numbers of sites is so dramatic that it is unlikely that it is exclusively an artifact of archaeological visibility. Therefore, there seems to be a real population reduction, or settlement disruption, in the Nanticoke drainage during terminal Woodland I times.

The Nanticoke population reduction and settlement disruption is not an isolated phenomenon and can be related to other regional events documented in the archaeological record of the central Middle Atlantic region. In Kent County, Delaware, there seems to be a fissioning of groups who inhabited large macroband base camps and an expansion of smaller microband base camps during Carey Complex times. This settlement pattern change has been linked to changes in social organizations and environmental circumscription (Custer 1982); however, the Carey Complex settlement shift in Kent County and the later population reduction in the Nanticoke area may be part of a single sequence of population disruption moving from north to south down the Delmarva Peninsula. Recent analyses of linguistic data (Feidel 1987; Luckenbach et al. 1987) suggest that migrations of various groups were taking place at this time and the terminal Woodland I population disruptions may be related to these migrations. Increased ceramic variability is also observed in the terminal Woodland I assemblages of this time period and may also be related to population reductions (Custer 1989). definite north-to-south trend in the appearance of grit-tempered Hell Island wares (Custer 1984a:84). In southern Delaware, Hell Island wares appear to be a short-lived technological intrusion which appears with no immediate technological antecedents. Gleach's (1988) analysis of the Mockley ceramic chronology also notes a hiatus in Mockley dates coincident with such an intrusion. Furthermore, the potential appearance of northern Clemson Island ceramics and the newly-noted similarities of the Island Field site with Clemson Island sites (Custer and Rosenberg 1988) also suggest a north-south movement of populations during terminal Woodland I times. Although the data and interpretations are confusing at this time, it is clear that people were on the move during terminal Woodland I times and these population disruptions seem to be reflected in the Nanticoke area survey data, and in the Sussex East-West Corridor.

Figure 27 shows the general model of Woodland I site types and the possible groups movements among the site types. Typical locations of these site types for the riverine zone within the project area are noted in Figure 28. Table 10 lists the potential site location descriptions for both riverine and interior portions of the study area.

Woodland II sites of the study area (Figure 29) and adjacent areas of southwestern Delaware (Figure 30) are included within the Slaughter Creek Complex and the adaptations of the Slaughter Creek Complex have been subjected to intensive study (Thomas et al. 1975). Building from a careful analysis of the potential food sources found in the different environmental zones of southern Delaware, Thomas et al. (1975) developed a series of models of archaeological site distributions for the groups of people that would be exploiting these food resources. Two basic

FIGURE 27
General Woodland I Site Model

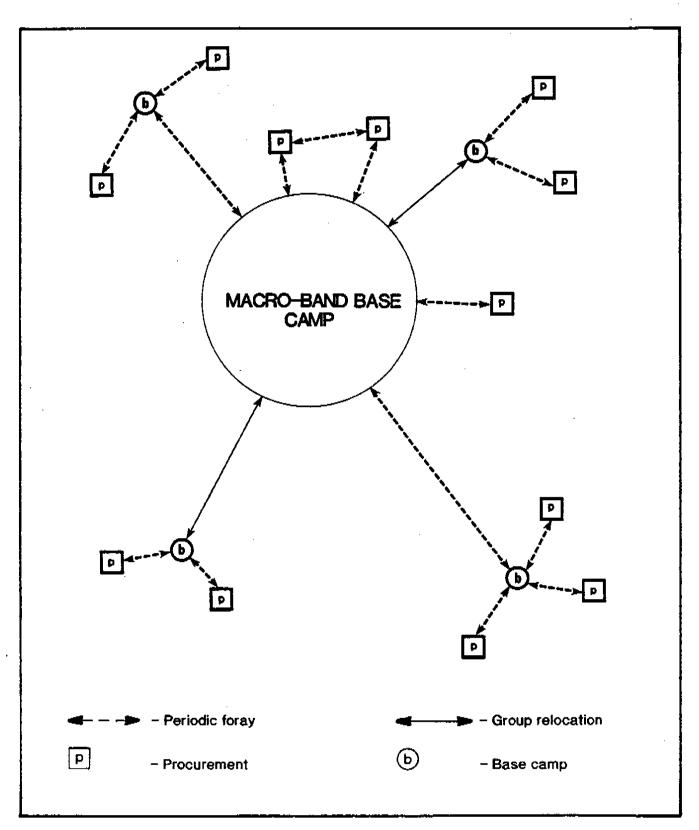


FIGURE 28
Woodland | Riverine Settlement Patterns

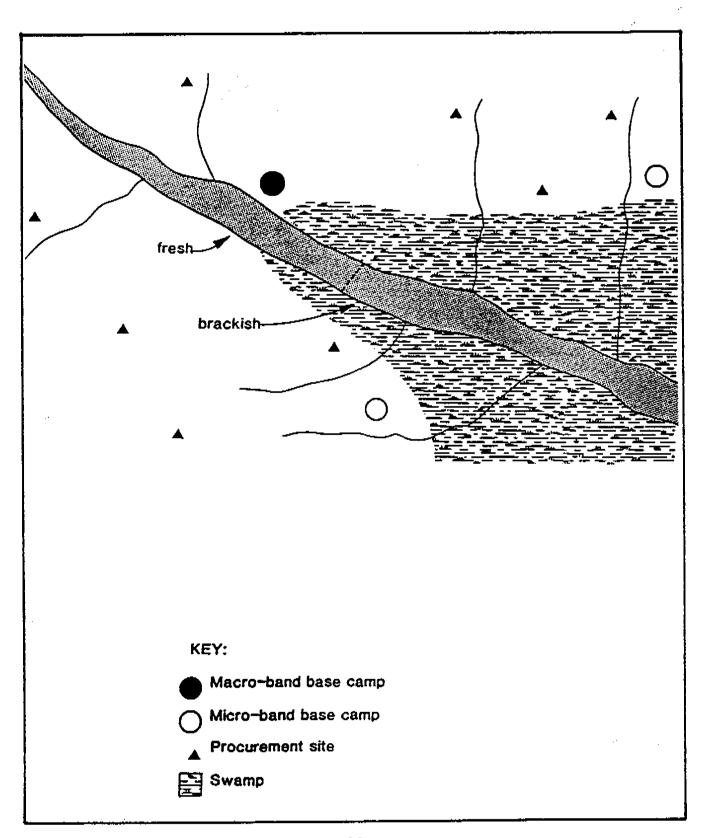
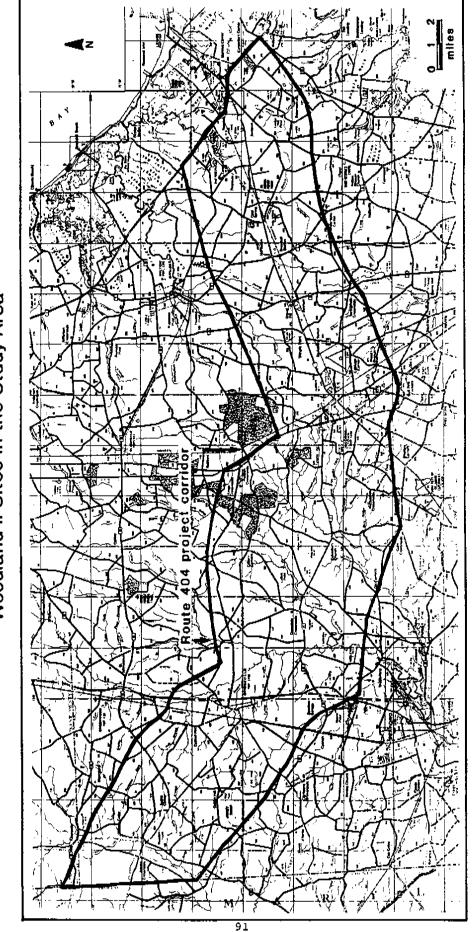
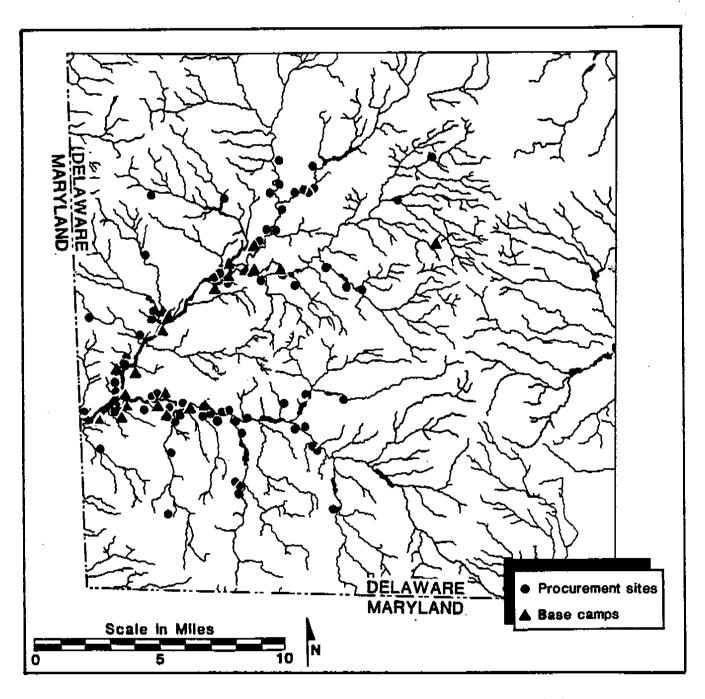


FIGURE 29
Woodland II Sites in the Study Area



* Site locations on file at DelDOT and U of D.

FIGURE 30
Woodland II Sites in Southwestern Delaware



site types were noted including seasonal camps and base camps (Thomas et al. 1975:62). Base camps would correspond to macroband base camps and seasonal camps would correspond to micro-band base camps. No projections are made concerning individual

- TABLE 10 --WOODLAND I STUDY UNITS AND SITE LOCATIONS Data Quality Study Units Site Types Location Riverine Zone fair macro-band low terraces of major base camp drainages at stream confluences and at saltwater/fresh water interface of the marsh micro-band confluences of low order streams and tidal base camp marshes procurement along minor and ephemeral drainages sites adjacent to poorly drained woodlands and on small sand ridges and knolls Interior Zone poor micro-band well-drained knolls at base camp springs and stream confluences well-drained knolls at procurement

procurement sites. Five basic models of the settlement patterns were generated from the analyses of potential food sources and each model projected different combinations of micro-band base camps in different environments during different seasons (Table 11). Each settlement model assumes a different degree of residential stability ranging from groups of transient micro-band base camps to single sedentary macro-band base camps of villages. After models were developed, the expected artifact distributions were noted.

sites

swamps and springs

Because there are few excavated sites in the Nanticoke drainage, it is difficult to say which of the models noted in

TABLE 11.

SLAUGHTER CREEK COMPLEX SETTLEMENT MODELS (Thomas et al. 1975:60-65)

Model	Winter	Spring	Summer	Fall
1	micro-band base camp; interior	micro-band base camp; mid- drainage	micro-band base camp; coastal	micro-band base camp; mid-drainage
2 ->	macro-band base camp; interior	micro-band base camp; mid- drainage	macro-band base camp; coastal	<pre>macro-band base camp;-> interior</pre>
3	macro-band base camp; interior	macro-band base camp; coastal	>	macro-band base camp; interior
4 ->	macro-band base camp; mid- drainage	>	micro-band base camp; coastal	<pre>macro-band base camp;-> mid-drainage</pre>
5 ~>	macro-band base camp; mid- drainage		. 	 >

Table 11 is the most accurate. It can be noted that by Woodland II times (A.D. 1000 - 1600), settlement intensity and population levels returned to levels comparable to those of the Woodland I period after their reduction during Late Carey Complex times. If anything, the settlement focus on the main stem of the Nanticoke and its major tributaries was even greater during Woodland II times. Temperature and moisture perturbations noted in the paleoenvironmental record for late prehistoric times (Brush 1986; Custer and Watson 1987) may be related to the settlement focus on the higher order streams. If the Woodland II sites from the lower Marshyhope (Flegel 1975a, 1975b, 1976, 1978; Callaway, Hutchinson, and Marine 1960; Corkran and Flegel 1953; Hutchinson, Callaway, and Bryant 1964; McNamara 1985) are considered, it can be noted that most of the sites seem to be microband base camps.

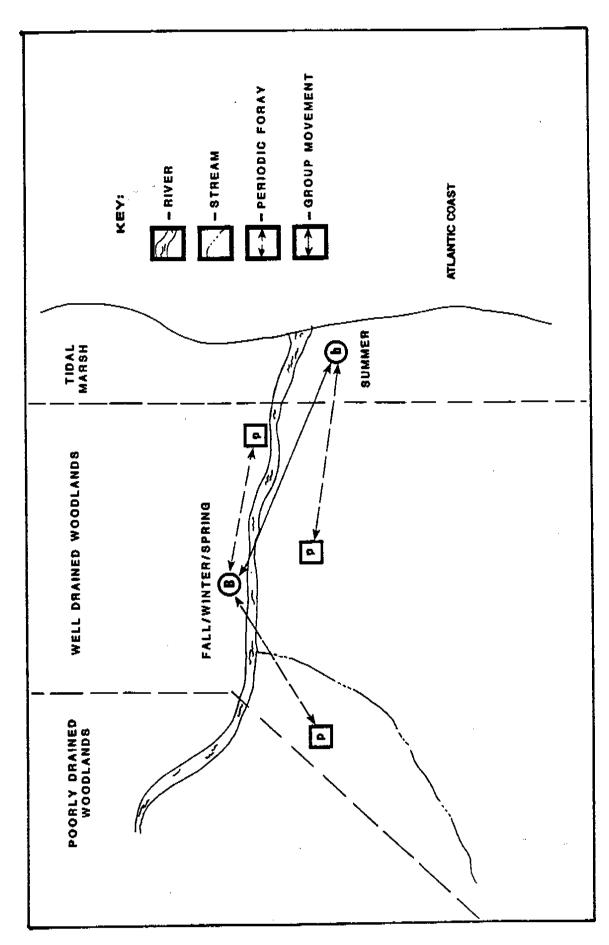
Therefore, Models III and IV (see Table 11) are probably the most accurate (Figures 31 and 32). These models have a moderate degree of residential stability and intensification of food production, use of storage, and group size could be maintained at low levels comparable to those seen in Woodland I times. Continuity in settlement patterns from Woodland I into Woodland II times seems to be present.

Because of the continuity in settlement patterns and basic adaptations between Woodland I and Woodland II times, the study units listed for the Woodland I Period (Table 10) would also apply to the Woodland II Period.

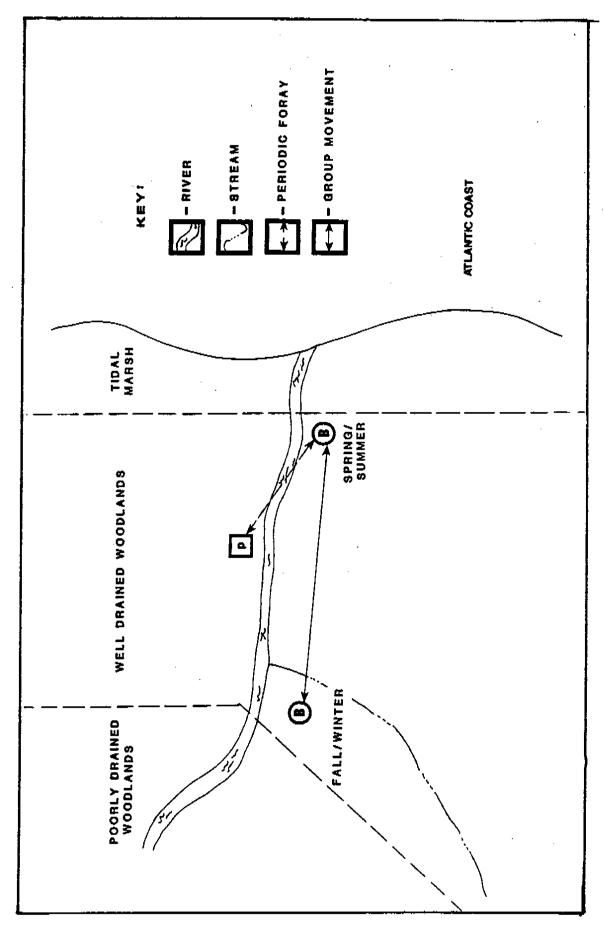
No Contact Period sites are known from the study area. Because the major effect of European Contact was the reduction of the local populations, the settlement patterns and site distributions of the Woodland II Period would apply, but their numbers would decrease. Data quality for all areas would be poor and site frequencies would decrease through time.

The models noted above provide a general guide to the types of locations where various types of prehistoric archaeological sites are likely to occur. However, the form in which they are presented above is not sufficient by itself for assessing the archaeological potential of a specific area, such as various portions of the project area. It is necessary to carry out additional analysis of the terrain of a given area and then compare the results of the analysis with the environmental settings depicted, or described in the models. Based on observed similarities, or differences, the archaeological potential of the

Woodland II Settlement Model III - Slaughter Creek Complex FIGURE 31



Woodland II Settlement Model IV - Slaughter Creek Complex FIGURE 32



area in question can be assessed. In most cases, the terrain analysis is carried out in a rather impressionistic way with no quantification of the degree of similarity between the ideal model and the actual terrain. However, newer techniques involving quantitative analysis have been developed by the Center for Archaeological Research and the Center for Remote Sensing of the University of Delaware. These techniques are described below and the description is taken from Custer, Jehle, Klatka, and Eveleigh (1984); Custer, Eveleigh, Klemas, and Wells (1986); and Eveleigh et al. (1983). It should also be noted that the model described below is directly derived from the more impressionistic models noted above.

The research by the University of Delaware has been oriented specifically towards the use of environmental data generated by the LANDSAT satellite. The LANDSAT satellite passes over the Delmarva Peninsula every eighteen days at an altitude of 920 km (Klemas 1977:387) and records four wave lengths of light using a multispectral scanner and a return beam vidicon. The data are recorded and transmitted in digital form and analysis is carried out using digital data. LANDSAT data can be used to classify and map various types of environmental zones by first identifying special categories of land classes on the ground. These areas called training sets can then be identified on the LANDSAT image and the special spectral characteristics of that area can be determined using a variety of statistical techniques (Klemas 1977). Once the special spectral characteristics have been identified, other elements of the LANDSAT image, called pixels, can be compared to the original training set and classified

accordingly. Mapping of environmental zones using LANDSAT is quite accurate and comparative studies of remote sensing methods and ground truth data indicate that LANDSAT data produces accurate classifications 87% of the time in coastal environmental settings (Klemas 1977:387). Also, the resolution of the mapping is approximately 80 meters which can discriminate among closely spaced environmental zones. Probably the most important feature of LANDSAT mapping of environmental zones, however, is the fact that it can allow the mapping of large areas very quickly and inexpensively.

Several researchers have attempted to apply LANDSAT data to In most cases LANDSAT data have been archaeological studies. used to map out varied environmental zones that can be correlated in a general way with archaeological site distributions (Hamlin 1977; Schalk and Lyons 1976). However, none of these studies has been able to generate specific maps of zones likely to contain archaeological sites. The major difficulty in applying LANDSAT data has been that most archaeologists who work with remote sensing techniques have attempted to look for specific onthe-ground features, such as crop marks, shell scatters, or architectural features, to locate archaeological sites (Ebert and Lyons 1976). Because resolution of the LANDSAT data is 80m it is generally unsuitable for the specific remote sensing of archaeological sites, although it should be noted that Quann and Bevan (1977) were able to recognize the shadow of the pyramids at Nevertheless, given the non-spectacular nature of the archaeological remains in the Middle Atlantic region, specific sensing of archaeological sites using LANDSAT is unlikely to succeed in all but a very few cases.

The work of Ian Wells (1981; Wells et al. 1981) provides an alternative approach to the application of LANDSAT data to archaeological modeling. Wells' work did not use LANDSAT data directly to generate an archaeological predictive model; however, he did use a geographic information system (GIS) that was similar to those that can be generated from LANDSAT. Rather than look for specific variables that could be correlated with archaeological sites locations, Wells considered combinations of environmental variables derived from the general models noted above that could be quantitatively correlated with known locations of archaeological sites such as distance to surface water of varying orders, distance to interfaces of well-drained and poorly drained soils, and the presence of special topographic features such as sinkholes, bay/basin features, or river levees (Wells 1981:41-46). This kind of snyoptic analysis is different from specific analysis in that it considers regional combinations of variables relevant to archaeological site locations rather than indications of specific site locations. As such, it was able to take advantage of the best features of the LANDSAT data.

Wells used a statistical technique known as a logistical regression (Chung 1978) to analyze the relationship between locations of known archaeological sites, as well as locations known not to contain archaeological sites, and environmental variables. Although other statistical methods have been successfully used in similar analyses (eg., Kvamme 1981), the logistical regression model was used because it can be applied to

gridded data bases, there are few restrictions on the distributions of independent variables, the dependent variable always lies between 0 and 1, and the algorithm is robust and can produce results even from noisy data (Wells 1981:23). The form of the logistic model, which estimates the probability that a certain cell contains at least one site is (Wells 1981:24):

PROB(Y(i)=1) =
$$E(Y(i)) = e^{X(i)'b}$$

 $\frac{------_{1+e}E(i)'b}{1}$

where

$$X(i)' = (1,X_{i1},X_{12},...X_{ip})$$

is a vector of the p predictor variables at grid cell i and

$$b = (b_0, b_1, \dots b_p)$$

is a vector of regression coefficients to be estimated. Y(i) is the independent variable between 0 and 1. The input to the logistical regression model consists of the Y(i) of known test sites (i.e., the probability value of 1 for locations known to contain archaeological sites and the probability value of 0 for locations known not to contain archaeological sites) and X(i), the observational values of the environmental variables.

A series of computer programs, called the ODESSA system, was developed by Wells to apply the logistical regression to an archaeological predictive problem. Simply stated, the ODESSA model first derived a logistical regression equation using the results of an archaeological survey of a section of the north bank of the Appoquinimink River in southern New Castle

County (Gardner and Stewart 1978) as a training set. environmental variables utilized were: distance to closest minor stream, distance to major steam or river (recognized in the data base as a dammed lake or reservoir), distance to openland rated (well-drained) soil, local gradient, convexity of the landscape, and distance to present marsh (Wells 1981:41-46). All of these variables were recorded for the study area in a 500' grid cell data base AERIS system developed for planning purposes in New Castle County. The ODESSA equations derived from the training set were in a sense a linear series of coefficients such that if the observed distances and variables were multiplied by the distance and observations for the variables, a location known to contain a prehistoric archaeological site would generate a value for the equation of 1. Similarly, a location known not to contain a site would generate a value of 0. Using an analysis of variance, the equations developed by Wells accounted for 72% of the variation of site locations in the training set (Wells 1981:41).

After the equations were developed, the ODESSA system was applied to an area that previously had not been archaeologically surveyed. The environmental variables for each cell were input to the previously developed equation and each cell's variables produced a value between 0 and 1. This value is the probability that the unsurveyed cell will contain an archaeological site. Wells produced a map of the cells likely to contain sites (p. 1) and field checks showed the predictions to be quite accurate (Wells 1981:49-54). In sum, Wells' use of the ODESSA model provides a way in which data similar to that gathered by LANDSAT

can be quantitatively linked to archaeological site locations on a synoptic basis. Most importantly, the ODESSA model produced probability maps for archaeological site locations. However, the ODESSA system did not use LANDSAT data and it was somewhat limited in its applicability in that it used an area of relatively limited environmental diversity (a floodplain and adjacent headlands) as a training set.

A more recent study of the Kent County area (Eveleigh et al. 1983; Custer, Eveleigh, Klemas, and Wells 1986) took the ODESSA model, with its use of the logistical regression analysis, and directly applied it to a new training set from the Kent County area that included a GIS of environmental variables developed directly from LANDSAT. A sample of site areas from the St. Jones/Murderkill drainage area was chosen as a training set because it was a controlled, stratified, random sample of a variety of environmental settings. Also, the Kent County area's general environmental structure was similar to the Appoquinimink area studied by Wells. Finally, the time range of the majority of sites discovered in both the Appoquinimink and St. Jones/Murderkill area was the same (ca. 3000 B.C. - A.D. 1000).

The first step in the Kent County study was to classify the LANDSAT image into culturally relevant environmental zones. Classification of the LANDSAT image was accomplished using computer programs of the Earth Resources Data Analysis System (ERDAS). In these programs the operator interactively picks a series of LANDSAT sensing units (pixels) that seem to have similar spectral characteristics and which seem to match with

culturally significant (Chenhall 1975) environmental variables. The programs report on the spectral characteristics and purity of the series by displaying histograms of pixel brightness and a series of statistical indicators. As accurate and useful classifications are obtained, they are saved in a signature catalogue file. This type of classification is termed a supervised classification (Klemas 1977:389) and 16 specified signatures were generated for the Kent County area. These signatures and their spatial distribution were then compared to infrared aerial photographs, color aerial photographs, and USGS topographic maps to insure their utility. Table 12 lists the variables that were utilized in the final classified scene. The classified scene was then converted to a 50m GIS by the ERDAS system.

The data base generated by the program contained a number of variables including percentages of ground truth grid cells that were classified into the variables listed in Table 12, and a series of minimum distance measures (converted to log distances) to a series of critical environmental variables (Table 12) similar to those shown to be important by Wells (1981:41-46). These variables formed the data base that was utilized in the ODESSA logistical regression model. The regression model was initially run using the variables listed in Table 12 and converged on a solution. The fact that the model converges on a solution implies that the variables selected do have some meaning for predicting locations.

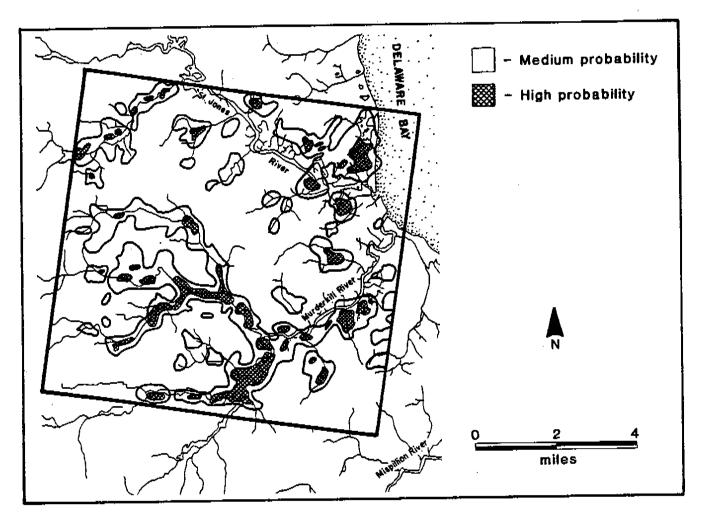
After the model had converged on a solution, the sections of the study area that had not been included as part of the 5%

-TABLE 12 -

VARIABLES USED IN LANDSAT CLASSIFICATION				
Variable Label	Ground Description	Edaphic Factor		
Deep Water	Bay and deeper parts of rivers	High order streams		
Shallow, Turbid Water	Turbid sections of rivers	Moderate order streams		
Shallow, Clear Water	Less turbid sections of rivers	Low order streams		
Salt Marsh 1	Tidal wetland with low productivity	High salinity marshes		
Salt Marsh 2	Tidal wetland with high productivity	Brackish and low salinity marshes		
Trees	Wooded areas	Very poorly drained soils		
Agricultural 1	High productivity farm land	Well-drained soils with some moisture retention		
Agricultural 2	Low productivity farm land	Well-drained soils with little moisture retention		
Bare Soil 1	Bare soils, dead grasses	Moderately drained soils		
Bare Soil 2	Bare soil, dead grasses	Moderately drained soils		

stratified, random sample were run through the regression equation and the probabilities for each cell were noted. Contour maps of the site probabilities (Figure 33) were developed and used as part of the original Route 13 Planning Study (Custer, Jehle, Klatka, and Eveleigh 1984).

FIGURE 33
St. Jones/Murderkill Probability Map



The predictive model has been subjected to several tests since its initial application to the Route 13 Project. Two planning studies of the Route 13 Corridor (Custer, Bachman, and Grettler 1986; Custer and Bachman 1986a), the Phase I survey of the final Route 13 Early Action Segment (Bachman, Grettler, and Custer 1988), a survey of the Murderkill drainage specifically focused on testing the LANDSAT predictive model (Gelburd 1988), and the test data generated from the original St.

Jones/Murderkill survey (Eveleigh, Custer, and Klemas 1983) all specifically tested the predictions of the LANDSAT model. Table 13 summarizes the test results from these studies and in all cases there are no significant differences between the model's expected results and the observed results of the surveys. Therefore, the accuracy of the model's predictions has been verified by field testing on several occasions.

Application of the LANDSAT predictive model to the Sussex East-West Corridor (Route 404) followed a similar approach to that used in the Route 13 project. The model was thought to be applicable to the Sussex East-West Corridor project area because the environmental settings of the Sussex East-West Corridor and Route 13 projects are very similar. Both are located in the Low Coastal Plain and have fairly extensive freshwater and brackish wetlands. Furthermore, soils in both areas are quite similar. Because of the environmental similarities between the two areas, the LANDSAT image of the Sussex East-West Corridor was classified into the same environmental zones used in the Route 13 Project (Table 12).

The Route 13 model used five main variables, all of which were related to the presence of surface water and wetlands of various types. A factor analysis of the environmental variables used in the model for the St. Jones/Murderkill area also shows that the main variables used in the logistical regression are highly inter-correlated (Table 14) and are measures of surface water and wetlands. As, as an experiment, a series of predictive maps were developed using only distance to the water measures as a predictor for archaeological site locations.

DELAWARE LANDSAT PREDICTIVE MODEL TEST RESULTS

Route 13 Phase I Survey (Bachman, Custer, and Grettler 1988)

Probability Zone	Total # of Quadrats	Expected # With Sites	Observed # With Sites
H	 8	7	1
M	25	15	4
L	223	22	19

Chi-square = 2.88, .25

Murderkill Drainage Survey (Gelburd 1988)

Probability	Total #	Expected #	Observed #
Zone	of <u>Quadrats</u>	<u>With</u> Sites	<u>With</u> Sites
H	4	4	4
M	17	11	15
Ĺ	56	14	10

Chi-square = 1.53, .1<p<.25

Route 13 Planning Study, Kent County (Custer, Bachman, and Grettler (1986)

Probability Zone	Total # of Quadrats	Expected # With Sites	Observed # With Sites
H	36	32	28
M	110	69	74
L	96	24	23

Chi-square = .9, .25

Route 13 Planning Study, New Castle County (Custer and Bachman 1986)

Probability Zone	Total # of Quadrats	Expected # With Sites	Observed # With Sites
H	<u> </u>	<u> </u>	17
M	37	23	27
Τ.	19	5	7

Chi-square = 1.16, .25<p<.50

St. Jones/Murderkill Test Data (Eveleigh, Custer, Klemas 1983)

Probability Zone	Total # of Quadrats	Expected # With Sites	Observed # With Sites
H		41	45
М	34	21	29

Chi-square = 3.44, .10

TABLE 14

FACTOR CORRELATION MATRIX - ENVIRONMENTAL VARIABLES				
Environmental Variable	Factor 1	Factor 2	Factor 3	
Shallow, Clear Water	.167	.693*	090	
Salt Marsh 2	.090	.595*	.068	
Salt Marsh 1	.387	.454*	032	
Trees	.199	.363*	.346	
Shallow, Turbid Water	246	.697*	109	
Agricultural 1	165	063	.5 05	
Agricultural 2	.195	093	.517	
Bare Soil 1	.633	096	168	
Bare Soil 2	.571	.033	.029	
Deep Water	323	.011	399	
* Inter-correlated variables These distance-derived maps are essentially identical to the				

predictive maps generated by the application of the logistical regression model. A distance-based approach was used to develop predictive maps for the main section of the Nanticoke (Custer 1989) and preliminary tests of the model's results (Table 15) shows it to be as accurate as the models derived from the application of the logistic regression.

Updates in equipment and software for satellite remote sensing at the University of Delaware since 1984 required revisions in the procedure developed by Eveliegh (1984). Customized FORTRAN programs (Kellogg 1990) were written to duplicate the logistic regression model on the new facilities. The revised programs reproduced the results of Eveleigh (1984)

TABLE 15-

COMPARISON OF PREDICTIVE MODEL AND SURVEY RESULTS FOR THE NANTICOKE DRAINAGE

Probability Zones

	High	Medium	Low
Expected	147	71	15
Observed	146	68	20
	Chi-square=1.39	D.O.F.=.2	p>.50

Source: Custer and Mellin 1989

and Custer et al. (1986) for the St. Jones/Murderkill region using the same data.

One modification was introduced into the production of predictive maps. Instead of calculating probabilities for large grid squares and then contouring the data as in Eveleigh (1984), predictive values were calculated for each pixel of the LANDSAT Thus a probability was determined for every 50m square of the study area based on the logistic regression results. A plotter output at a scale of one inch per mile was transfered to the 7.5' quadrangle maps of Attachment II. Probability values were grouped as follows: high probability zones have siteoccurrence probability values greater than 0.70, medium probability zones have site-occurrence probability values between 0.50 and 0.70, and low probability zones have siteoccurrence probability values less than 0.50. It should be noted that the low probability zone is not devoid of sites. Sites may still be present, but they will be present in significantly lower frequencies compared to the medium and high probability zones.

It can also be noted that the high probability zones will contain most of the base camp sites that have the greatest potential for being sufficiently significant to warrant nomination to the National Register of Historic Places. medium probability zone contains mainly micro-band base camps which are also likely to be eligible for the National Register, but are smaller, and less expensive to study, than the sites in the high probability zones. The low probability zone contains mainly procurement sites which are much less significant, unlikely to be intact, and not likely candidates for the National Register. Even if they are deemed significant enough for listing on the register, they are the least expensive to mitigate. Thus, the probability zones shown in Attachment VI are a guide to general locations of classes of sites of varying significance. Further discussion of management considerations is provided in the final section of this report. The zones mapped in Attachment VI can also be combined with the diagrams of typical site locations (Figures 18-21, 31, and 32) and lists of descriptions of typical locations (Figures 22-26, 29, and 30) to note specific individual site locations within the study area.

HISTORIC SITES

The predictive models utilized for historic settlement patterns within the project corridor were developed from the inventories of standing structures at the BAHP, which are listed in Appendix II, from the comprehensive historic state plan developed by Ames et al. (1987) and Herman and Siders (1986), and from the data concerning historic archaeological sites obtained

from historic atlases, road papers, and other historic sources, shown in Appendix III. According to Ames et al. (1987:38), Sussex County in general, and the project corridor in particular, offers a unique opportunity to examine cultural resources which evolved in a relatively stable demographic context. Settlement patterns within the County were reinforced instead of replaced, and newer development was integrated with the old, creating an historic landscape in which the changes over time are still evident (Ames et al. 1987:37). The integration and slow replacement of historic settlement patterns suggests that many historic sites are present within the project corridor as archaeological sites, dating from all time periods across the corridor.

predictive models and potential site locations for each of the chronological periods are presented below. Sites dating from the 1830 to 1880 and 1880 to 1940+ periods are well-represented by standing structures, and have extensive historical documentation available to aid in site location predictions. Additionally, since the overwhelming majority of known and potential historic resources within the project corridor date at least from the middle of the nineteenth century to the twentieth century, the development of predictive models for these time periods are less critical than for the time between initial settlement of the region in the 1630s to the 1830s. For these periods, Beers'(1868) Atlas and Bausman's (1941) "Map of Land Uses" provide adequate site location data. Conversely, the lack of existing standing structures and known

and/or potential archaeological sites within the project corridor that date from the first three chronological periods makes the use of predictive models for site location crucial if these site types are to be adequately identified and sampled. For these reasons, the chronological periods of 1630 to 1730, 1730 to 1770, and 1770 to 1830 are discussed in more detail, and a series of maps are included to indicate areas of varying degrees of potential site locations.

1630-1730

Based on the work of several historical archaeologists and geographers in the Middle Atlantic region and elsewhere (Miller 1980; Wise 1980; Custer, Jehle, Klatka, and Eveleigh 1984:102-113; Lewis 1976: 14-15; Rubertone 1986; Blouet 1972; Earle 1975), settlement patterns in the project corridor dating from this time period were characterized by a reliance on waterways. Historically, settlement was circumscribed by the drainages within the region, such as the Mispillion, Broadkill, Indian River and Bay, Assawoman Bay, and the smaller tributary creeks, such as Cool Spring Branch, Bundick's Branch, Herring Creek, and Lewes Creek. In the western portion of the project corridor, the region claimed during this time period by Maryland and Lord Baltimore, the Marshyhope and the Nanticoke served as the foci of settlement. Limits of historic settlement during this period will be found approximately 10 to 12 miles from the Atlantic Coast, or to the heads of the eastern-flowing drainages in the project corridor, and probably within 1/4 to 1/2 of a mile from the Nanticoke and Marshyhope drainages. presents areas within the project corridor that have varying

Potential Site Locations, 1630-1730

FIGURE 34

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1630-1730:

- Thigh: These areas contain high potential for historic site locations they are adjacent to drainages, and sites will be located within 300-500 feet of these waterways in the eastern portion of the corridor, and up to 1/4 to 1/2 mile in the western portion (Maryland lands).
- II. Medium: These areas are less likely to be site locations they are interior settings away from water; probably utilized for grazing and woodlands.
- III. Low: These areas are extremely unlikely to contain site locations these are interior well-drained and poorly drained woodlands with little or no water access. Documentary evidence suggests that this area functioned as a "frontier" zone with bandits, robbers, and lordless inhabitants.

levels of potential for historic site locations dating from this time period, and additional locational and intra-site data for the 1630 to 1730 period is detailed below.

The Dutch at Lewes, and at other locations on the shores of the Delaware estuary such as Appoquinimink and New Castle, instituted a system of "long lots" which fronted on and extended inland from the waterways (Custer et al. 1984:103; Delaware Division of Historic and Cultural Affairs 1976:15; Wise 1980:7;). Other researchers in the Middle Atlantic have identified a similar "long-lot" system in Virginia, Pennsylvania, and New Jersey (Wise 1980:7). Based on the results of the Atlantic Coast Comprehensive Survey undertaken in the late 1970s, Wise (1980:4) has postulated that historic sites dating from this time period will be located within 300 feet (100 yards) of the drainage on which they fronted.

The long-lot pattern allowed easy access to navigable water, which also served as the primary mode of transportation

and communication, since overland travel was severely limited by dense woodlands and marshes. Lots laid out using the long-lot sytem varied considerably in size, those in towns like Lewes being fairly small, while those established by patents from the Penn government on the south side of Indian River contained several hundred acres (Figure 35). In the late seventeeth-early eighteenth centuries, the Penn government also divided land up in haphazard, irregular lots, generally consisting of about 200-acre parcels (Eastburn 1891). Like the long-lot system, these irregular parcels always contained some water source, and usually had a stream serving as a property line, or running through the parcel. Within the project corridor, irregular lots of this pattern will be found along the Nanticoke and Marshyhope drainages, and west of the immediate vicinity of Lewes, around Cool Spring Branch and Bundick's Branch.

Regardless of the lot system used to lay out a parcel, dwellings and "plantations" were generally constructed on well-drained soils with small agricultural field(s) close-by. The low population density of Sussex during this period is reflected in the distances between plantations, which ranged from 0.25 to 1.5 miles from each other (Earle 1975; Hancock 1962). Tobacco was the major agricultural crop at this time, along with livestock raising. Land use of this type suggests that plantations of the period would exhibit an intensive use of the land in the immediate vicinity of the dwelling house and outbuildings, with a patchwork of new and old fields, but significant portions of the property would be kept in woodland

FIGURE 35
Map of Sussex (1740)

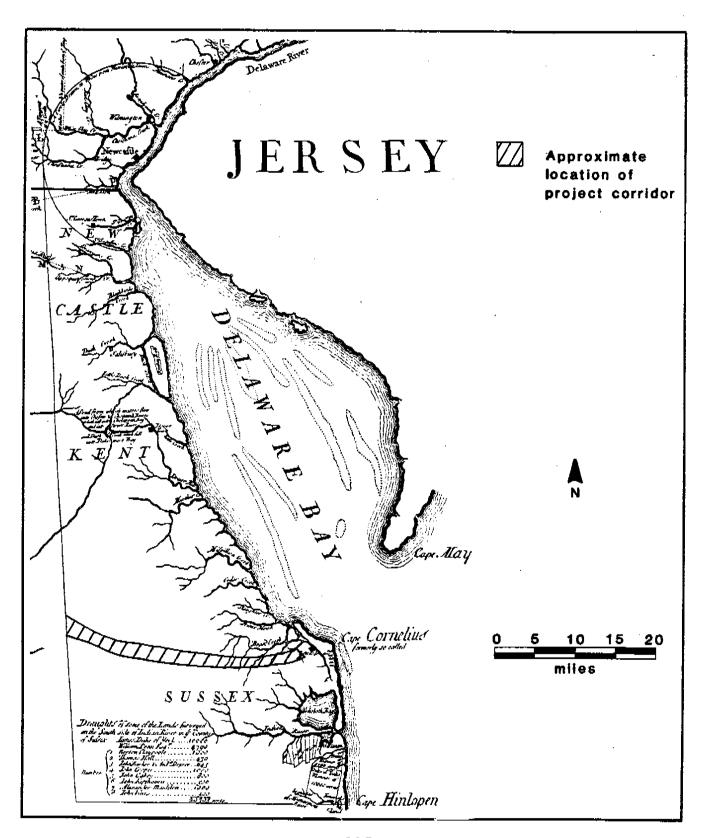
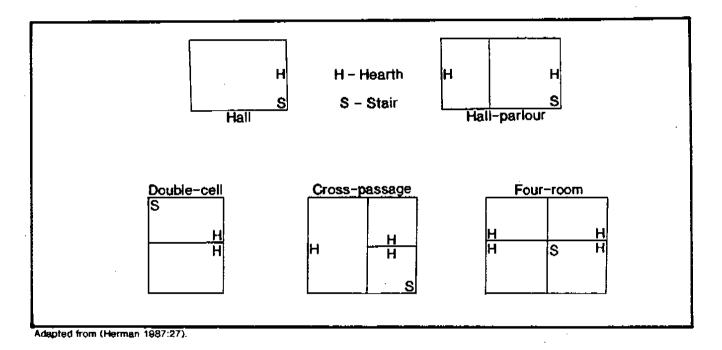


FIGURE 36
Examples of Eighteenth Century Traditional
Dwelling Plans in Sussex County, Delaware



or marsh for cattle forage. Structures present on agricultural complexes dating to this period would have included small dwelling houses generally built of wood (frame or log), and only rarely of brick. Dwelling plans included a range of traditional options such as hall, hall-parlor, double-cell, cross-passage, and four-room (Herman 1987:27) (Figure 36). House foundations were generally of earthfast or impermanent construction, a building style that characterized much of the architecture of North America during this period (Carson et al. 1981; Kelso 1984; Herman 1987:84). A variety of outbuildings such as kitchens, tobacco and grain sheds, milk houses, barns, smokehouses, and meat houses would have been present on the farmsteads (Herman 1987:61-72). Job-specific buildings, such as

ship carpentry shops and blacksmith shops, were few in number, and were located primarily in the Lewes area.

The town of Lewes during this period was the only "urban" location in Sussex. Lewes functioned as a center of social, political, economic, and religious activities, and as the entrepot between Sussex County and the upper Delaware communities, overseas to Europe, and the West Indies. In this capacity the town fits Lewis' (1976:14) definition of a "frontier town".

There are only 3 historic sites which date to this time period in the project corridor (Table 8). Two are standing structures --Coolspring Church (S-138) and the Richards House (S-827), both constructed in the first quarter of the eighteenth century; the other is the archaeological site of the Fisher-Martin House (S-137), which was recently moved into Lewes. All three of these sites are listed on the National Register. No other sites dating from this period are presently known in the project corridor, though more could be expected. Specifically lacking are the impermanent sites from the earliest occupation of the area, and their immediate, more durable replacements. Sites dating to this period are therefore significant cultural resources and have high potential within the corridor.

1730-1770

During this time period historic settlement extended westwards across the drainage divide and spread eastward from the Nanticoke and Marshyhope watersheds. The boundary between Maryland and the Three Lower Counties (Delaware) was settled at

the close of this period; prior to that time the Nanticoke River and it's tributaries served as the provincial line. Because of this border dispute, there were overlapping land grants issued by both governments in this portion of the project area. The land grant patterns of the previous period continued into this one, with large, irregular parcels often bounded by a water course located in the interior of the peninsula. Water continued to function as the primary transportation and communication medium, and overland routes, though present, were poor. The few roads that did exist were primarily regional connectors, running from the Chesapeake Bay across to the Delaware Shore, and from Lewes up country to Philadelphia, or local secondary roads. Figure 37 presents the areas within the project corridor that have high site probabilities and potentials from this time period.

settlement pattern during the second quarter of the eighteenth century may have shifted from a water-oriented plantation to a more inland focus (Wise 1980). A settlement shift of this nature was probably due to the change from tobacco agriculture to grain agriculture that occurred in the early eighteenth century in southern Delaware (Munroe 1978). Grain agriculture would have required more extensive land clearing and planting, thus allowing more mobility in dwelling and farmstead location. Documented population increases, caused by immigration from overseas, and overland from the Eastern Shore, would have also contributed to the change in settlement orientation. This change from water to land has been suggested for historic sites

Potential Site Locations, 1730-1770

FIGURE 37

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1730-1770+:

- I. High: These areas contain high site location potential.

 They include the earlier areas of settlement, and reflect the settlement pattern change from water to interior, and from tobacco to grain agriculture.
- II. Medium to Low: These areas contain medium to low potential for historic site locations. These are areas of welldrained, droughty soils.
 - = Early village settlement locations from this period

located along the St. Jones River in Kent County (Wise 1980), but whether the pattern is applicable to Sussex County, and the project corridor in particular, is not known at present.

The change in settlement pattern orientation was reflected in changes in plantation layout and architecture. Starting in the 1740s, Georgian architectural house forms began to appear, and more permanent methods of construction and material types were utilized (Carson et al. 1981; Herman 1987:26,109-110). Livestock raising continued to be an important occupation of the area's inhabitants, and home manufactures were added by the middle of the eighteenth century to the subsistence economy of Sussex's inhabitants (Main 1973; Jordan 1914). Outbuildings reflected the changes in agriculture, with a disappearance of tobacco sheds, the presence of more durable granaries, and barns, and the addition of structures related to home manufacturing, such as weaving houses.

In the western portion of the project corridor, large tracts of forest land and swamp were taken up by the iron companies that were established in the second half of the eighteenth century.

These iron plantations required large amounts of charcoal and wood supplies to operate, which required extensive tracts of timber. A dispersed pattern of settlement was therefore maintained in the vicinities of the forges, though the population of the forges may have been relatively high, and the furnace complexes themselves contained a variety of structures, such as grist and saw mills, blacksmith shops, dwelling houses, stables, and perhaps churches (Heite 1974; Virginia Gazette 1770; Lewes Presbytery Minutes 1758-1810).

Several small "commercial towns" (Heite and Heite 1986) were established in the project corridor by the middle of the eighteenth century. Commercial towns were those that appeared at prominent crossroads or navigation locations, and served as focal points for the local economy and society, such as Bridgebranch (Bridgeville), Warwick, and at Head of the Broadkill (Milton). These towns usually consisted of a tavern, a bridge or fording place, a grist mill or saw mill, wharves if on a navigable river, maybe a store and perhaps some domestic dwellings. The economic effect of these small towns during this period was probably negligible on the overall region, or on the economy, and Lewes remained the only major urban location in Sussex.

A total of six historic archaeological sites and four standing structures dating from this time period are known to be located within the project corridor. Three of these archaeological sites are located in the western portion of the project corridor, in Nanticoke and North West Fork hundreds; of

these, two are forge locations, Old Furnace (S-478) and Unity Forge (S-432). The other three archaeological sites are dwelling locations in Broadkill and Lewes and Rehoboth hundreds. The four standing structures include the Short Farmstead (S-410), a National Register site, and the Hopkins House (S-410), Poplar Level Farm (S-377), and S-5144. All of these are agricultural or dwelling complexes, and date from the 1750s. As with the previous period, archaeological sites from this period are considered to be significant and to contain high potential.

1770-1830

This period of time within Sussex County saw a great deal of change and development of the landscape, as new areas were brought into cultivation, new towns and market centers were founded, and the forests were lumbered off (Figure 38). Subsistence agriculture (predominately corn production), forestry, and home manufactures continued to dominate the economic growth of the project corridor in this period. For the most part, dwellings were constructed of log or frame, with only a few brick houses. Farmsteads were small and averaged few buildings, typically including a house, a smokehouse, one or two corn barns, and perhaps a stable and speciality structure like a loom house or weaving shed. The occupation of the land by tenants rose during this period, and many of the farms in the project corridor were considered to be "out plantations", or tenant-occupied farms (Herman 1988; Garrison 1988).

The population of the county grew from about 14,000 in 1775 to over 24,000 in 1790. Though the population fluctuated throughout the remainder of the period, it generally rose, and

miles

FIGURE 38 Potential Site Locations, 1770-1830

1770-1830:

- I. High: These areas represent zones of high site location potential for this period. The zones are located along the major transportation routes that developed in the interior after the founding of Georgetown in the early 1790s. Sites will be oriented towards the roads, though not necessarily immediately adjacent to them.
- II. Medium: These areas represent zones of medium historic site location potential. They are located inland from the zone I areas, and were utilized during the period as lumbering, grazing, and some farming land. Within this zone, historic sites will most likely be oriented to secondary overland transportation routes, and possible to water routes.
- III. Low: Areas that are representative of zones of low historic site location potential. These zones are located in areas of exceedingly well-drained soils, where corn agriculture would have been difficult. Where zone I areas cross these lands, the potential for site locations may be higher.
 - = Settlement areas these are zones of increased settlement or nodal activity, such as Bridgebranch (Bridgeville), the Forge locations (Collins Forge, old Furnace, Gravelly Delight Forge), and Mill seats (Collins Mill, Ross' Mill [near Woolenhawk]).

reached over 27,000 by 1830. The early growth may be attributable to the acquisition of Maryland lands in the 1770s (the settling of the boundary issue), and the rise in population over time is indicative of the increased development of agriculture, the rise of tenancy, and home manufactures in the region (Herman and Siders 1986:79).

The founding of the "planned town" of Georgetown in the 1790s was a significant event in the history of Sussex, because it reflects the changing social and economic environment of the period. By the start of the nineteenth century, Georgetown was followed by the establishment of other centralized market place

towns like Seaford, Laurel, Milton, and Millsboro, and these towns stimulated the growth of the interior portions of Sussex Although not large by regional standards, these commercial towns became foci of service and merchant locations. and shops, stores, wharves, and taverns were located in them. The iron industry located in the Nanticoke watershed began to decline in economic importance during this period, and the lands sold off for farming and lumbering. Mill seats became significant locations in the project corridor during this period, and often were the center of other service-oriented structures, such as blacksmith and wheelwright shops, and Religious diversity in the County was reflected by the erection of numerous churches and chapels in interior locations throughout the project corridor, most notably Methodist and Baptist churches.

Water-oriented transportation and commerce remained the primary means of business and communication, with two major foci of shipping in Sussex. The towns of Seaford and Laurel were oriented towards the south and the Chesapeake, while Indian River, Rehoboth Bay, Milton and Lewes faced the Atlantic and were part of the economic hinterland based on Philadelphia.

During this period the landscape of the project corridor was transformed, with more land cleared and put into agricultural production, an intensive deforestation of the interior portions of the county, and improvements in the internal transportation network (Herman and Siders 1986:80). All of these changes were reflective of larger-scale significant economic and social

changes, as more land was occupied by the poorer classes of farmers and tenants.

There are at present 25 potential historic archaeological site locations within the project corridor (Table 8). The largest number of these are located in Northwest Fork Hundred, and include agricultural complexes and dwellings, and two saw mills. Nanticoke Hundred contains five potential site locations, including two forge locations, a bridge, and a grist mill and mill dam. The remainder of the hundreds within the project corridor have four or less sites. Though there are comparatively more potential sites within the corridor dating from this time period than from the two earlier periods, these sites locations are well-documented, and are considered to be significant and to have high potential.

1830-1880

It is during this time period that the amount of cleared land within Sussex County reached its apex, and with this clearing a rise in population and a revolution in farming (Figure 39). Changes in agriculture in Sussex were manifested during this period by the reclamation of waste and forest lands, and by the ditching and draining of low swamp lands. Major transportation changes, most obviously the arrival of the railroad in the County in the late 1850s, spurred the further development of the interior of Sussex, forcing the occupation, clearing and farming of previously marginal lands. Within the project corridor these lands are located at the drainage divide, south and west of Georgetown in the vicinity of Flea Hill, and east as far as Sand Hill (Bausman 1941).

Potential Site Locations, 1830-1880

FIGURE 39

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1830-1889:

- These areas represent zones of high site location potential for this period. The zones are located along the primary and secondary transportation routes in the The construction of the raliroad(s) in the Corridor. Corridor during this period provided new impetus for settlement, and change in agricultural practices from predominantly corn agriculture to market gardening and truck farming. Large numbers of new roads were established during this period, connecting the interior areas with transportation and service centers, like towns and railroad depots. Water transportation, though still important, has less effect on the project corridor, and serves mainly as attractive shipping points at Seaford and Milton, both outside the Corridor.
- II. Medium: These areas represent zones of medium site location potential. Sites in these zones, and one located to the interior of zone I areas. These zones are occupied mostly by agricultural complexes and tenant houses, and in many cases will be located on new or recently reclaimed or marginal lands. Other site types which may be found in this zone include steam saw mills, lumber complexes, and grist mills. The new truck farming and market gardening are the catalyst for opening up previously unfarmed lands.
 - Settlement/villages. These are areas of increased nodal activity, particularly related to changing transportation patterns. Special locations from this period include the railroad depots, like Bennum, Harbeson, and Coolspring, and the black community of Belltown. Outside of the Corridor are the towns of Seaford, Lewes, and Milton, which directly effect the transportation network within the Corrridor.

During this period, the number of new roads constructed or created within the project corridor was greater than in any previous period, particularly roads which ran from interior locations to railheads and stations. Land was used for truck farming and orchard crops such as peaches and strawberries, though subsistence agriculture and corn production was still predominant as a major agricultural product of the county.

Subsistence farming continued to reinforce dispersed settlement, but the housing stock in the project corridor improved during this period. By 1860, earlier dwellings were being replaced and enlarged by two-story hall-parlor or centerpassage single pile dwellings, with barns, corn cribs, and stables as outbuildings (Herman and Sider 1986:87).

The railroad directly created several new town locations in or near the project corridor, such as Greenwood and Ellendale, and at the same time allowed other cross-roads locations to decline in importance. These towns provided new foci for urban settlement, and railroad oriented services and other emerging industries were constructed at these locations. In addition, several religious "new towns", such as Rehoboth, were founded during this period. Earlier churches were also replaced or enlarged at this time with more fashionable stuctures (Herman and Siders 1986:87).

All of these changes -- population increases, new transportation routes, gradual shifts in agriculture from subsistence to market gardening, land clearing and reclamation, and the establishment of new urban centers -- are suggestive of changing social, cultural and economic values within Sussex County. Though agriculture was still the predominant occupation of the people of the project corridor, significant urban locations contrasted with the rural nature of the region, and the rise of the tourism industry reveals changes in social perceptions of leisure time.

Settlement patterns during this period are most easily viewed by examining Beers' Atlas (1868), which is the first

detailed map of the project corridor. There are a total of 367 potential historic archaeological sites dating from this period within the corridor (Table 8). The number of sites dating from this period is clearly a bias in the data. Nearly a third of these historic sites are located in Nanticoke Hundred, followed by Northwest Fork Hundred, Georgetown Hundred, and Lewes and These numbers are reflective of both the Rehoboth Hundred. amount of project corridor passing through these hundreds, and the relative levels of population growth and historic development for these hundreds. The overwhelming majority of site types within the corridor dating from this period are identified as agricultural complexes (288), with considerably fewer numbers of dwellings (12), dwelling complexes (14), schools (10), and family cemeteries (10). It should be noted that many of these historic sites were probably occupied at an earlier date than the 1830-1880 period, but that this is the earliest documentary data available for these sites.

Issues of historic significance and potential for sites dating to this period should be addressed on a case-by-case basis, taking into consideration site type, the integrity of the archaeological remains, number of sites of this type, the presence of standing structures of the same type, associated outbuildings or architectural remains, and the like.

1880 to 1940

Herman and Siders (1986:93) have characterized the existing landscape of the region as one that is a reflection of the agricultural practices and markets that were created or practiced during the 1880 to 1940 period (Figure 40). The most obvious

o 1 2 mlles Potential Site Locations 1880-1940+

FIGURE 40

1880-1940+

- I. High: These areas represent zones of high site location potential for this period. As in the previous time period, the zones are located along primary transportation routes, particularly strip-development along Route 13 and Route 113. Alterations in agricultural practices, particularly the shift to a "corn soybean chicken complex", the important perishable produce industry, and improving transportation routes and facilities serve to concentrate settlement along the roadways and around the growing urban centers of Georgetown and Bridgeville, and to a lesser extent around Gravel Hill, Bennum, Broadkill Station/Harbeson, and Five Points. This zone has contracted somewhat from the previous period, but population density overall has risen due to the abandonment of interior areas.
- II. Medium/Low: These areas represent zones of medium to low site location potential for this period. The changing nature of agricultural production in the Corridor during this period resulted in the abandonment of agricultural complexes associated with marginal lands or poorly drained areas, and the improved transportation routes re-oriented settlement from these interior areas. Much of this land, particularly in the central and western portion of the project corridor, is timber land, and is used for lumbering.
 - Urban centers these are the significant urban locations in the project corridor, and include Bridgeville, Georgetown, and Five Points.

changes that can be seen today are the mechanical cultivation of large field areas, natural forests confined to watercourses or nature preserves (such as Ellendale and Redden State Forests), and a network of roads which serve to shorten the distance between the "backcountry" and towns in the county. There has been a decline in forest area in the county, and an increase since 1940 of the number of channelized and ditched drainages. Bausman (1941:7) has identified a 25% decline in the number of farms in Sussex since 1880, attributable to the exhaustion of marginal soils for farming.

The existing housing stock within the project corridor dates from this period or later, including barns, corncribs, sheds, perishable-related buildings (potato houses, etc.), chicken houses, tractor sheds, and other sheds. In fact, about 77% of the housing stock in Sussex County was constructed after 1940, as either new construction or the enlarging or replacing of older buildings (Ames et al. 1987:58).

The rise in popularity of the automobile as a means of transportation has had a profound effect on the county, especially with the creation of new roads, such as Route 13 and Route 113. New roads in turn have provided new economic opportunities, particularly in the service-related industries (service stations, resturants), which is evident by the "strip development" in sections of the project corridor along major regional connectors. Improved transportation also sparked the further development of market gardening and perishable crops, as well as continued growth of the tourism industry.

The development of the broiler industry which began in the 1920s has experienced a tremendous change from the previous agricultural methods followed in the area, and in land use patterns related to chicken farming. Large chicken houses are readily apparent on the landscape, and are a ubiquitous part of the agricultural growth of Sussex County.

There are twelve known archaeological sites dating to this time period in the project corridor (Table 8). All of these were identified from the BAHP inventories. Considerably more standing structures dating to this time period are present within

the project corridor and can provide more significant cultural information than archaeological sites of the same time. Thus archaeological sites dating to this time period are not considered to be as significant as sites from former periods, and the standing structures offer better potential for data retrieval.

Unknown Dates: Cemeteries

There are twenty-seven historic sites in the project corridor for which no date is known at present. These sites are church cemeteries (Table family and exclusively Identification of these sites was accomplished by oral reports, by the BAHP site files, and by examination of the USGS topographical maps. Family and church cemetery sites are significant cultural resources within the project corridor, and have the potential to provide important information to the existing body of data regarding historic Delaware demographics. They are significant because they graphically illustrate the "continuity" over time of the inhabitants of Sussex County, a phenomenon noted by Bausman (1941) nearly fifty years ago. These sites are rather special cultural resources and should be field checked and have dates obtained for their use and occupation.

MANAGMENT CONSIDERATIONS AND RECOMMENDATIONS

The previous sections of this report have focused on compiling and listing the known and potential cultural resources for the project corridor, and has provided a prehistoric and historic cultural context in which to study them. In this section of the report three issues will be addressed: 1)

consideration of the known and potential significance of the cultural resources; 2) notation of areas of the project corridor that are most "sensitive" in terms of cultural resources; and 3) recommendations about future stages of the cultural resources management process. Specifically, areas of the project corridor that will require intensive archaeological research efforts to mitigate the effects of the proposed highway development will be noted, and potential research methods and mitigation costs will be discussed.

Considerations of site significance is critical for a management study such as this one because the level of site significance in large measure determines the kinds of further archaeological investigations which may be required by Federal law. In particular, the eligibility of a site for listing on the National Register of Historic Places, which is based on significance, needs to be addressed because the eligibility of the site for National Register inclusion ultimately determines the needs for further work. Discussions of site significance, and the potential eligibility for the National Register, are provided below for prehistoric and historic archaeological sites.

PREHISTORIC SITE SIGNIFICANCE

The management section of the Delaware State Plan for the Management of Prehistoric Archaeological Resources (Custer 1983b:Chapter 8), similar plans for the upper and lower Eastern Shore of Maryland, and regional management plans (Custer 1983c, 1987, 1989; Davidson 1982), provide the bases for assessing prehistoric site significance. The Delaware plan

divides the state into various zones which have varying sensitivities for containing significant archaeological sites. Figure 41 shows the location of these zones in relation to the project area. It can be seen that some portions of the project area fall into the highest sensitivity zone while other portions have a lower sensitivity. Although this reveals something of the potential significance of project area sites, a more detailed consideration which addresses individual site type significance is needed.

One way to consider the potential significance of sites within the study area is to use the series of management zones noted in the state plan. Figure 42 shows the management zones and their relation to the study area, while Table 16 identifies the management zones, and Table 17 shows their relation to the sensitivity zones. Three management units, Mid-Peninsular Drainage Divide, Mid-Drainage, and Coastal, are included in the study area. Tables 18-20 list the various site types from different time periods and note their potential significance, the general probability of their occurrence, and the quality of the data relating to them. These listings generally indicate which types of sites are most likely to be significant within the study area.

More specific significance data can be developed for specific sections of the project area by comparing the sites listed in Tables 18-20 with the probability zones mapped in Attachment VI, and their descriptions listed in Appendix I. The descriptions of typical locations and lists of site types included by time periods provide the best match of significant

FIGURE 41

Delaware Prehistoric Composite Sensitivity Zones

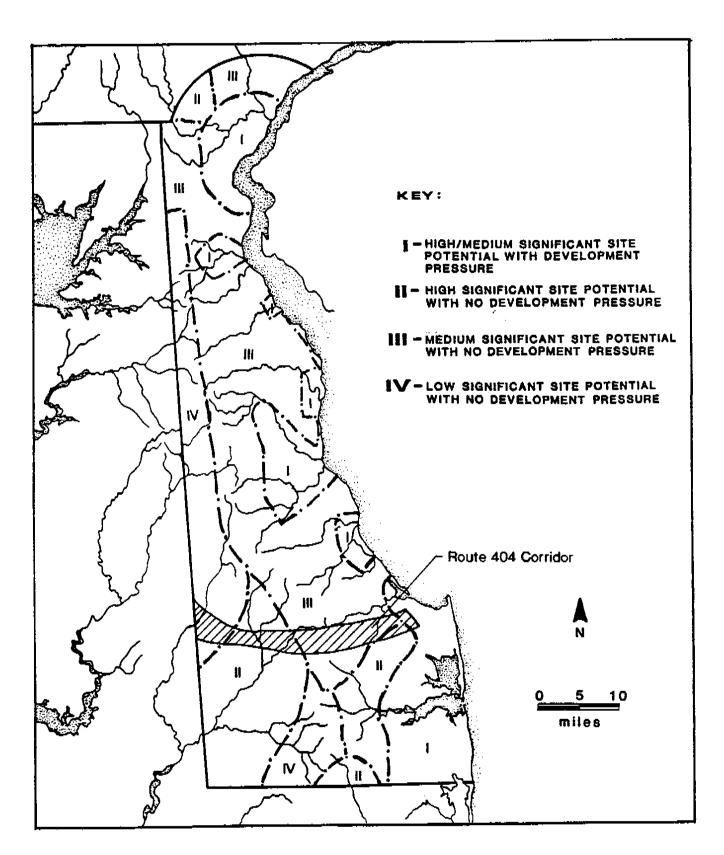
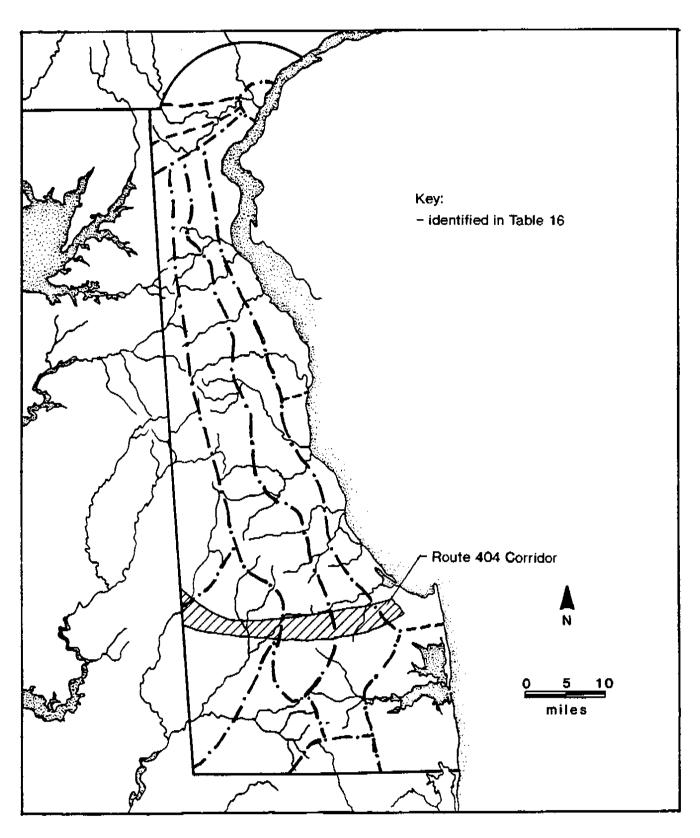


FIGURE 42
Delaware Prehistoric Management Units



DELAWARE MANAGEMENT UNITS

- 1 Northern Delaware Management Unit
 - la Piedmont Uplands (Archaic Woodland II)
 - 1b Fall Line (Woodland I and II)
 - 1c Delaware Chalcedony Complex (Paleo-Indian)
- 2 Interior Swamp Management Unit
 - 2a Churchmans Marsh Includes New Castle Contact Study
 Unit
 - 2b Upper Pocomoke
- 3 Interior Management Unit
 - 3a Northern Sub-Unit
 - 3b Southern Sub-Unit
- 4 Mid-Peninsular Drainage Divide Management Unit Includes Mid-Peninsular Drainage Divide

Non-Quarry Paleo-Indian Site Complexes

- 5 Mid-Drainage Management Unit
 - 5a Delaware Drainage
 - 5b Nanticoke Drainage
- 6 Coastal Management Unit
 - 6a Northern Bay
 - 6b Southern Bay
 - 6c Atlantic Coast

site types and probability zones. In order to determine the types of significant site types that might be contained within any probability zone, the numbered zone from the map in Attachment VI can be compared to the listed description in Appendix I. Then, the site types listed in Appendix I can be compared to the significant site types listed in Tables 18-20.

A quick check of the major probability zones noted in Attachment VI and Appendix I shows that usually the largest high probability zones contain significant micro-band base camps and macro-band base camps. In most cases, the high probability zones along the major drainages contain significant sites that are from the Archaic and later periods. Areas with potential Paleo-Indian

MANAGEMENT PRIORITIES

Category I (more than 50% in Zone I)

Fall Line sub-unit of Northern Delaware Management Unit Churchmans Marsh sub-unit of Interior Swamp Management Unit Atlantic Coast sub-unit of Coastal Management Unit South Bay sub-unit of Coastal Management Unit

Category II (more than 50% in Zones I and II)

Piedmont Uplands sub-unit of Northern Delaware Management Unit

Upper Pokomoke sub-unit of Interior Swamp Management Unit Mid-Peninsular Drainage Divide Management Unit Nanticoke sub-unit of Mid-Drainage Management Unit

Category III (more than 50% in Zone III)

Delaware Chalcedony Complex sub-unit of Northern Delaware Management Unit Delaware sub-unit of Mid-Drainage Management Unit Northern Bay sub-unit of Coastal Management Unit

Category IV (more than 50% in Zone IV)

Interior Management Unitsites, which would automatically be significant given their scarcity, as well as later sites are generally restricted to high probability zones that are associated with interior sand ridges.

Medium probability zones along lower order interior drainages most likely will contain micro-band base camps post-dating the Archaic Period. If these sites have not been plowed, or otherwise destroyed, they are likely to be significant. Smaller procurement sites are also likely to be found in these isolated medium probability zones; however, their significance is not likely to be as great. At least, fewer are likely to be undisturbed and significant. Even if they are significant, the costs of their mitigation and excavation is much lower than the

SITE PROBABILITIES AND DATA QUALITY - MID-PENINSULAR DRAINAGE DIVIDE MANAGEMENT UNIT

Site Types	Site Probabilities	Data Quality
Paleo-Indian quarry quarry reduction quarry related base camp	L L L	F F F
*base camp *base camp *base camp maintenance station	M-H M-H	F F
*hunting sites DATA QUALITY	H F	F
Archaic macro-band base camp *micro-band base camp *procurement site DATA QUALITY	L L-M M P	P P P
Woodland I macro-band base camp micro-band base camp *procurement site DATA QUALITY	L L-M M P	P P P
Woodland II macro-band base camp micro-band base camp procurement site DATA QUALITY	L L-M M P	P P P
Contact general Contact sites DATA QUALITY	L P	P

*Sites likely to yield significant data

KEY:

Site Probabilities Data Quality

L - low	P - poor
L-M - low to medium	P-F - poor to fair
M - medium	F - fair
M-H - medium to high	F-G - fair to good
H - high	G - good

SITE PROBABILITIES AND DATA QUALITY - MID-DRAINAGE MANAGEMENT UNIT

Site Types	Site Probabilities by Sub-Units Delaware	Data Quality
Paleo-Indian	Sub-onics belower	Zunrre]
quarry	L	P
quarry reduction	L	P
quarry related	Ľ	P
base camp	_	_
base camp	<u>L</u>	P P
base camp maintena	ance L	P
station	L-M	P
hunting sites	P	F
DATA QUALITY	F	
Archaic		
macro-band base ca		P
micro-band base ca		P
procurement site	M	₽
DATA QUALITY	P	
Woodland I		
*macro-band base ca	amp H	F-G
*micro-band base ca		F-G
*procurement site	H	F-Ģ
*major mortuary/ex	change H	P-G
sites		
*minor mortuary/ex	change H	P-F
sites		
DATA QUALITY	F-G	
Woodland II		
*macro-band base c	amp M	P
*micro-band base c		P
*procurement site	H	F-P
DATA QUALITY	P-F	
Contact		
general Contact s	ites L	P
DATA QUALITY	P	•
*Sites likely to yield	significant data	
KEY: Site Probabilities	Data Quality	
T. Jon	P - poor	
L - low L-M - low to medium	P-F - poor to	fair
M - medium	F - fair	
M-H - medium to high	F-G - fair to	good
H - high	G - good	3
11 - 111911	O 9000	

SITE PROBABILITIES AND DATA QUALITY -COASTAL MANAGEMENT UNIT

Site Types	Site Prob By Sub-U	Data Quality	
	North Bay	South Bay	·
Paleo-Indian quarry quarry reduction quarry related base camp base camp base camp maintenance station hunting sites	L L L L M	T T T M	PPPP
DATA QUALITY	₽	P	
Archaic macro-band base camp micro-band base camp procurement site DATA QUALITY	L L M P	L L M P	P P
Woodland I *macro-band base camp *micro-band base camp *procurement site *mortuary site DATA QUALITY	L M-H H L P	L M-H H H F-G	F-G F-G P
Woodland II *macro-band base camp *micro-band base camp procurement site DATA QUALITY	M M H P	н н н F-G	F-G F-G F-G
<u>Contact</u> *general Contact site DATA QUALITY	L P	L P	P-F
*Sites likely to yield signi:	ficant data.		
Key:			
Site Probabilities L - low L-M - low to medium M - medium M-H - medium to high H - high		a Quality P - poor P-F - poor to F - fair F-G - fair to G - good	

larger base camp sites. It should be noted that macro-band base camps may be present in these medium probability areas; however, they will be uncommon.

In the low probability zones, the frequency of any kind of base camps is expected to be quite low. Frequencies of procurement sites will be high, but in general, the low probability zones are the least sensitive with respect to prehistoric cultural resources. Nonetheless, it is possible that a few significant sites will be found in the low probability zones.

In sum, the probability zones can be used as a rough guide to potential site significance and sensitivity. The high probability zones have the greatest sensitivity and the greatest potential for significant sites. Medium probability zones have less potential and a lesser sensitivity and low probability zones have the lowest potential and are the least sensitive.

HISTORIC SITE SIGNIFICANCE

In Appendices II and III the archaeological potential and the archaeological significance of all of the historic resources indentified within the project corridor are assessed on a site specific basis. The significance of the historic standing structures inventoried in Appendix II is not addressed in this report; rather, the potential of archaeological remains associated with the structure is assessed. The archaeological potential in this context refers to the potential of a site to contain undisturbed, archaeologically meaningful cultural remains. The issue of site integrity is incorporated in this

definition. The archaeological potential of a site was evaluated on the basis of information obtained from the BAHP standing structure inventory files, background historic research for the project corridor, and through examination of current editions of USGS 7.5' quadrangle maps. In Appendices II, III and IV the potential of a site is categorized as: 1) (Y), yes, exhibits archaeological potential; 2) (N), no, exhibits no archaeological potential due to severe disturbance or destruction of the site; and 3) (U), unknown, there is at present no basis for making an evaluation of the archaeological potential of the site.

The evaluation of the archaeological significance of a project site is tentative and the evaluations are presented only as management tools. The preliminary character of the data base necessitates a qualifying statement. On the basis of preliminary data compiled for this report, the significance of the potential archaeological remains is evaluated. Four levels of significance are used in the evaluation process: (H), high, (M), medium, (L), low, and (\mathbf{U}) , unknown. The criteria applied in the evaluation integrated temporal, functional, and social-historical data. Table 21 presents the criteria applied to the data base to determine the potential archaeological significance of historic resources (after Wall 1981:146-147; see Schiffer and Gumerman 1977:229; see Custer et al. 1984 for use of these criteria in planning process). The criteria are not presented in any rank order, nor are they intended to be all-inclusive. The evaluation of the historic resources according to the criteria was based on presently available archaeological data. As additional information is obtained more refined determinations of the

CRITERIA FOR EVALUATING THE ARCHAEOLOGICAL SIGNIFICANCE OF POTENTIAL HISTORIC RESOURCES

- Age: Sites providing information on early settlement, technology commerce, industry, or lifeways are more significant.
- Regional Interest: Sites which have impact on regional or local research problems are more significant.
- 3. National Interest: Sites which have impact on national or universal research problems are more significant.
- 4. Preservation: Sites containing well-preserved structural, faunal, floral, or skeletal remains are more significant.
- 5. <u>Multi-function:</u> Sites exhibiting a range of well-defined activity/functional loci are more significant.
- 6. <u>Uniqueness:</u> Sites containing rare or unique features (technological innovations, slave-related components) are more significant.
- 7. Previous Knowledge: Site types about which little is known are more significant and those which provide information on poorly understood social-historical contexts are more significant.
- 8. <u>Public Significance:</u> Sites which may easily be used in public education programs due to site contents and accessibility for public viewing are more significant.
- 9. Size and Density: Larger sites and those containing dense deposits of material culture are more significant.
- 10. Famous Events or Persons: Sites associated with a person or event of local, regional, or national interest are more significant.
- 11. <u>Duration of Occupation</u>: Sites exhibiting discrete temporal loci whether in the context of long-term or short-term occupations are more significant.

significance of historic resources within the project corridor will be possible. Each historic resource assessed is expected to provide additional information on criteria listed in the

Significance column in Appendices II and III. All historic sites within the project corridor have been mapped according to their significance level on 7.5' USGS quadrangle maps (see Attachment V).

MANAGEMENT UNITS

The final step in developing a series of management guidelines for the proposed project area was to combine the spatial data on site significance and develop a series of management units that could be mapped for the entire project The term "management units" comes from a Federal guide to cultural resource management planning (Heritage Conservation Recreation Service 1980), and refers simply to spatial areas that exhibit similar distributions of cultural resources of similar types and significance. Management units are usually developed by overlaying maps of known and potential resources of various types, and potential significance. Areas with similar distributions of significant resources are then noted as individual study units. A similar method was utilized in the development of prehistoric management units in the Delaware State Plan for the Management of Prehistoric Archaeological Resources (Custer 1983b).

To generate management units for the Sussex East-West Corridor, the site significance and prediction data presented in Attachments V and VI and in Figures 34 and 37 through 40 were combined to develop management units. For the purpose of this study, management units were chronologically divided into a pre-1830 historic period (combining

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MANAGEMENT ZONES

Zone	Prehistoric	Pre-1830	Post-1830
I	H, M, or L	н, м	M, L
ΙĪ	Ĺ	н, м	H
III	M	н, м	${f L}$
IV	L	M, L	H
v	М	L	H
VĪ	L	L	Ľ

KEY:

H = high
M = medium
L = low

KEY TO ZONES:

I = Major Drainages
II = Early Road Network
III = Lower Order Drainages

IV = Secondary Roads

V = Interior Regions, well-utilized
VI = Interior Regions, less-utilized

significance, locational, and predictive data from the first three historic periods), and a post-1830 historic period (combining significance, predictive, and locational data from the last two historic periods). Analysis of overlapping zones showed that there were six basic types of management units, each with a different combination of site types with varied These management units are listed in Table 22. significances. Figure 43 shows an overview of these management units in the project corridor, and Attachment VII shows the distribution of the management zones on each U.S.G.S. 7.5' map for the corridor. The zones used for this study are based on those used by Custer et al. (1984:129) for the Route 13 Corridor, and are defined as Zone 1 are areas related to major drainages, Zone II are areas containing the early road network, Zone III contains areas adjacent to secondary water courses, Zone IV contains areas related to secondary road networks, Zone V contains areas

- Zone VI: Interior lands - Zone V: Interior lands - Zone III: secondary drainages - Zone IV: secondary roads major drainages - Zone II: primary roads

FIGURE 43
Management Units

of fairly well-utilized (i.e., agricultural) interior regions, and Zone VI contains areas of less utilized (i.e., lumbering) interior lands.

The management units noted above can also be viewed as sensitivity zones for cultural resources because, as has been noted previously in this section, the predictive zones mapped in Attachments V and VI are directly related to potential presence of significant sites. Also, the definitions of the management zones noted in Table 22 were developed based specifically on site significance. In general, the Management Units listed in Table 22 are ranked in terms of significance with Unit I having the highest potential for the most significant sites and Unit VI having the lowest.

An examination of Figure 43 and of the maps in Attachment VII shows that most of the higher sensitivity zones are found adjacent to drainages and early road networks (Units I and II). Units with a more moderate significance (Units III-IV) are mainly located near secondary roads and lower order watercourses and the units with the lowest sensitivity (Units V and VI) are located in interior regions.

MANAGEMENT STRATEGIES AND RECOMMENDATIONS FOR FUTURE WORK

Before considering the possible uses of the data presented in this report, it is important to consider its limitations. Similarly, it is important to note inappropriate uses of the management data. As was noted in the introduction to this report, the data presented here should <u>not</u> be interpreted as a substitute for a cultural resources location and identification

survey of any specific alignments within the project area that are chosen at a later date. Also, the assessments of potential National Register significance cannot be viewed as final determinations of eligibility for any sites in the proposed project area. The only exception would be the few sites that are already listed on, or determined eligible for, the National Register. What the report does do is provide reliable and accurate estimates of expected site distributions in the study area and notes the potential significance of the expected sites. However, the delineation of potential site distributions should not be taken for final inventories of expected sites and alignment-specific inventories based on field survey will be a necessary part of future location/identification surveys.

with the limitations noted above in mind, it is possible to outline a number of possible applications of the management data presented in this report. These applications are listed below:

1) The management zones listed in Attachment VII can be used as guides to the sections of the project area that will be potential "problems" during future phases of the project. Herein, "problems" refers to the existence of significant resources that will cost both time and money to mitigate potential adverse effects. Generally, these problem areas would include all areas classified as Zones I and II on the maps in Attachment VII. 2) The data presented in this report can be used to develop plans and strategies to deal with the problem areas noted above. One simple strategy that could be developed would be to use the maps of management/sensitivity zones in Attachment VII to delineate areas that could be avoided, if at all

possible. In these areas, the maps of specific prehistoric site probability zones (Attachment VI) and historic sites (Attachment V) could be used to avoid specific high probability, high significance zones. This level of site avoidance would be most applicable at the level of specific engineering and design, as opposed to general alignment selection. Avoidance of areas with high probabilities of significant sites is a preferred option both because the costs to the Delaware Department of Transportation for mitigation are minimized and because the impact on the cultural resource base is lessened.

If avoidance is not possible due to design or cost considerations, the data presented in this report can be used as a rough guide for potential fieldwork that might be required. general, Phase I location/identification surveys will have to be done for most, if not all, of the proposed alignment areas. Also, Phase II excavations to determine the National Register eligibility of any prehistoric or historic sites discovered during the Phase I survey will be necessary. Thus, except in a few cases to be discussed later, once a final alignment is chosen, Phase I and II surveys will have to be carried out along its entire length. However, only certain sites will require Phase III data recovery excavations, or recordations in the case of standing structures. Such sites would be those determined eligible for the National Register of Historic Places and the present report will be useful both as a regional summary of known sites and research goals to help determine what sites are significant and as a guide to where significant sites may be located.

_____TABLE 23 _____

LEVELS OF FIELD INVESTIGATION BY PREHISTORIC SITE TYPES					
Site Types	Location and Identification	Phase II	Data Recovery		
Paleo-Indian/Early Archaic quarry (U) (P)	X X		•		
quarry reduction (U) (P)	X X	X X			
quarry-related base camp (U) (P)	X X	X X	x x		
base camp (U) (P)	X X	X X	x x		
base camp maintenance station	n (U) X (P) X	X X	x x		
hunting sites (U) (P)	X X	х	х		
Middle Archaic macro-band base camp (U) (P)	X X	X X	х		
micro-band base camp (U) (P)	X X	X X	х		
<pre>procurement site (U)</pre>	X X	X X	х		
<u>Late Archaic - Middle Woodland</u> macro-band base camp (U) (P)	Σ X	x x	х		
micro-band base camp (U) (P)	X X	X X	х		
<pre>procurement site (U)</pre>	x x	x	Х		
Late Woodland macro-band base camp (U) (P)	x x	x x	х		
micro-band base camp (U) (P)	X X	X X	x		
<pre>procurement site (U)</pre>	X X	X X	x		
KEY: (U) - unplowed (P) -]	plowed				

For prehistoric sites, Table 23 lists the varied functional site types for each time period and notes the levels of field investigations that would be appropriate given either undisturbed (unplowed) or disturbed (plowed) contexts. various settlement models and maps listed in this report can be used as a guide to determine where these various site types are likely to occur and estimates of potential numbers of sites requiring Phase III data recovery excavations can be noted. similar listing for historic sites is not possible because as yet the comparative data base for Delaware is poor and decisions of significance and need for further research will have to be made on a case-by-case basis. However, it can be noted that most of the predicted site locations dating from between 1630 and 1830 are likely locations for Phase III data recovery excavations. Also, it is difficult to imagine what types of potentially significant sites from later time periods would not be eligible for Phase III data recovery excavations or recordation. final use of the plan will be to make specific recommendations about the research and field methods to be used in the Phase I location/identification surveys. These recommendations are listed below:

- a) All standing structures within the proposed alignment should be field checked against the BAHP survey records and an inventory of sites for the alignment should be developed. The significance of these structures should be assessed on a case-by-case basis by a competent architectural historian.
- b) All sites with standing structures (Appendix II, Attachment II) should be assessed for the potential of associated historical deposits and the archaeological deposits and the structures at a single site should be considered as a single cultural resource, not as two unrelated topics.

- The documented historic site locations listed in Appendix III and mapped on Attachment III, which do not have associated standing structures, should be viewed as a special class, or stratum, of potential historic site locations that should be specifically checked for associated archaeological remains.
- Areas denoted as having a high probability for historic sites dating from 1630-1830 should also be viewed as a special class of potential historic site locations and should be checked especially carefully for archaeological remains of that time period after the completion of in-depth archival research to identify documented settlement locations. Remaining areas within the alignment that need to be checked for historic sites can be surveyed as part of the general fieldwork that will look for both historic and prehistoric sites.
- All areas within the alignment noted as high or medium e) probability zones for prehistoric sites should be carefully checked during the Phase I survey. Low probability areas should also be surveyed; however, it may not be necessary to completely survey all low probability zones. It is suggested here that a nonproportional stratified sample could be used in some project areas during the Phase I survey. For example, we can be fairly certain that many of the low probability areas on interior flats with no associated surface water and no poorly drained settings are unlikely to contain any sites. Even if they do contain sites, the sites are likely to be small lithic scatters that do not usually contain such significant data. a few cases these sites have been studied (e.g., Limestone Hills Site Complex noted in Custer (1981) and the Archaic component of the Lancaster County Park site reported by Kinsey and Custer [1982]) and they have yielded few artifacts and little significant data. Also, these kinds of topographic settings are likely to be plowed and disturbed, further reducing the chance that they would produce significant data. Finally, these sites are so ubiquitous that the number that might be disturbed without recordation is a very small fraction of the resource base. With these arguments in mind, it is suggested here that prior to the beginning of the fieldwork portion of the Phase I survey, these areas described above be delineated in consultation with the DelDOT Archaeologist and engineers and the staff of the Delaware Bureau of Archaeology and Historic Preservation, and that only a controlled sample of them actually be surveyed in the Phase I research. This will probably cause substantial savings of time and money which may be better spent in the high significance areas along the major drainages.

f) The site data in Appendices I through IV have been entered into a computerized data base (d BASE II) and can be cross-tabulated and sorted by individual variables or combinations of variables. These cross-tabulations can be used to assess the uniqueness of certain classes of cultural resources.

In conclusion, this report has documented the known and potential cultural resources of the project area and outlined management considerations for use in project planning. Hopefully, use of this information will help to minimize the project's impact on the cultural resources in the Sussex East-West Corridor (Routes 404/18, and 9) in Sussex County, Delaware.

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APPENDIX I

PREHISTORIC SITES INVENTORY

For a copy of Appendix I please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

KEY FOR APPENDIX I

	g Site
Symbols	Archaeological Site Large Base Camp Macro-band Base Camp Micro-band Base Camp Procurement/Processing Site Prehistoric Unknown
ion	II II t) It II II II
Site Function Symbols	ARCH SITE LARGEBC MACROB MICROB P/P PREH.
	Historic Prehistoric Woodland I Woodland II Archaic Paleo-Indian Unknown
ymbols	HIS = PREH. = WI = MII = P = P = P = P = P = P = P = P = P =
Date S	HIS PREH. WI WII A A P

Site Potential Evaluation Symbols Unknown Potential Yes Potential No Potential EL 11

Sussex

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County Symbols

Site Significance Evaluation Symbols

High Significance	Medium Significance	Low Significance	Unknown Significance
Ħ	11	ll	II
Ħ	Σ	ı,	D

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APPENDIX II

STANDING STRUCTURE INVENTORY

FROM BUREAU OF ARCHAEOLOGY AND HISTORIC PRESERVATION FILES

For a copy of Appendix II please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

KEY FOR APPENDIX II

Date Symbols	Site Function Symbols	Lion	Symbols
p = pre	AGBLDG	11	Agricultural Outbuilding
a = after	AGCX	11	Agricultural Complex
c = circa	AGMCX	II	Agricultural-Mill Complex
UNK = unknown	ALMHSE	H	Almshouse
L = late	ARCH SIT	11	Archaeological Site
E = early	BRID	II	Bridge
•	CEM	11	Cemetery
	CHUR	II	Church
Site Potential	COMCEN	11	Community Center
Evaluation Symbols	DWCX	11	Dwelling Complex
	DWLG	ti	Dwelling
POT = Site Potential	FORG	11	Forge
N = No Potential	GMILL	11	Gristmill
Y = Yes Potential	SCH	II	School
U = Unknown Potential	SERVST	11	Service Station
	SMIL	11	Sawmill
Site Significance	STO	! l	Store
Evaluation Symbols	WTOWR	II	Water Tower
<pre>SIG = Site Significance H = High Significance M = Medium Significance L = Low Significance U = Unknown Significance</pre>			
County Symbols	National	Regis	National Register Symbols

National Register Eligible Listed

H H 0

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County Kent Sussex

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KEY FOR APPENDIX II (cont.)

Description Symbols

Brick	Cemerery	Church	Community Center	County Prison	Demolished	Family Cemetery	Frame	Honse	Log	Mortar	Methodist Church	Out of Right-of-Way	Standing Structure	Stucco
n	II	11	B1	u	11	ij	II	16	11	Н	11	H	II	u
BR	CEM	CHUR	COM CT	CO. PRIS.	DEMO	FAM CEM	FR	H	ŋ	Œ	METH CHUR	(ORW)	SS	STUCO

Symbols References

REFS = References	Beer's Atlas of the State of Delaware, 1868.	reau of Archaeology and Historic Preservation Standing	Structure Inventory Files.	Custer, Jay F. and Glen R. Mellin, 1989.	llin Survey, 1989.	uis Berger and Associates, Inc., U.S. Route 113 Survey, 1989.	Heite, Edward F., 1974.	1913 Farm Directory	usman, R.O., 1941.	Purnell, H.W.T., 1962.
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APPENDIX III

POTENTIAL HISTORICAL ARCHAEOLOGICAL SITES INVENTORY

For a copy of Appendix III please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

KEY FOR APPENDIX III

Quadrangle Map Symbols

ELD = Ellendale
FAR = Fairmont
GEO = Georgetown
GRN = Greenwood
HAR = Harbeson
HICK = Hickman
LEW = Lewes

MIL = Milton

SEFE = Seaford East SEFW = Seaford West

Hundred Symbols

BDK = Broad Kiln
BRK = Broad Creek
CED = Cedar Creek
GEO = Georgetown
INR = Indian River

L&R = Lewes and Rehoboth

MIS = Mispillion NAN = Nanticoke

NWF = Northwest Fork

Date Symbols

A = 1630-1730+/-B = 1730-1770+/-C = 1770-1830+/-D = 1830-1880+/-E = 1880-1940+/-

Site Potential Evaluation Symbols

N = No Potential
Y = Yes Potential
U = Unknown Potential

Site Significance Evaluation Symbols

H = High Significance
M = Medium Significance
L = Low Significance
U = Unknown Significance

National Register Symbols

X = Listed

KEY FOR APPENDIX III (cont.)

Site Function Symbols

Agricultural Complex AGCX Agricultural Tenant Dwelling AGTE = Almshouse ALMH = Bridge BRID Blacksmith/Whitesmith Shop BSSH = Church Cemetery CCEM = Church CHUR = Dwelling DWLG = Dwelling Complex DWCX = Family Cemetery FCEM = Forge FORG = Gristmill GMIL = Mill Dam MDAM = Office ÖFFÏ -School SCH = Sawmill SMIL Store STO = Storehouse STOH = Street Mill STML

References Symbols

- B = Beer's Atlas of the State of Delaware, 1868.
- C = Bureau of Archaeology and Historic Preservation Standing Structure Inventory Files.
- M = Mellin Survey, 1989.
- N = Louis Berger and Associates, Inc., U.S. Route 113 Survey, 1989.
- O = Oral Interviews and Topographic Maps
- P = Heite, Edward F., 1974.
- R = Road Paper
- T = United States Geological Survey Map

APPENDIX IV

LIST OF UNINVENTORIED STANDING STRUCTURES

For a copy of Appendix IV please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

KEY FOR APPENDIX IV

Cou	inty	<u>Symbols</u>	Descript	tic	on Symbols
K S	E-		SCH = CEM = DEMO =	= =	Church School Cemetery Demolished Out of Right-of-Way

ATTACHMENT I

PREHISTORIC SITE LOCATIONS

For maps with site location information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT II

STANDING STRUCTURE SITE LOCATIONS

For maps with site location information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT III

POTENTIAL HISTORIC ARCHAEOLOGICAL SITE LOCATIONS

For maps with site location information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT IV

UNINVENTORIED STANDING STRUCTURE LOCATIONS

For maps with uninventoried standing structure location information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT V

LEVELS OF SIGNIFICANCE FOR HISTORIC RESOURCES

For maps with levels of significance for historic resources information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT VI

PREHISTORIC PREDICTIVE ZONES

For maps with prehistoric predictive zones information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903

ATTACHMENT VII

MANAGEMENT UNITS

For maps with managment units information please contact:

Delaware Department of Transportation Division of Highways Location and Environemtnal Studies Office P.O. Box 778 Dover, De 19903